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AVIATION AND COSMONAUTICS

Commander's Teaching Methods Detailed

91440067a Moscow AVIATSIYA I KOSMONAVTIKA in Russian
No 1 Jan 88 (signed to press 2 Dec 87) pp 1-3

[Article by Maj Gen Avn V. Shpak, Honored Military Pilot USSR: "The Commander: Organizer and Teacher"]

[Text] Air Forces units and subunits have begun a new training year that is a special year for Air Forces personnel as it is for all Army and Navy personnel: the USSR Armed Forces are celebrating their 70th birthday. This also leaves a special imprint on all aspects of troop life and operational training activity and on all aspects of socialist competition in military collectives.

In the report "October and Restructuring: The Revolution Continues" presented at a joint ceremonial session of the CPSU Central Committee, USSR Supreme Soviet and RSFSR Supreme Soviet dedicated to the 70th anniversary of the Great October Socialist Revolution, CPSU Central Committee General Secretary Comrade M. S. Gorbachev noted that the jubilee is a moment of pride, a moment of remembrance, a moment of reflection, and a look at the future. Mikhail Sergeyevich emphasized that "our achievements are grandiose, ponderable and significant. They represent a firm foundation, the basis for new achievements and for society's further development."

In evaluating in his or her mind's eye the path covered by our Motherland and its Armed Forces, no military person—citizen of the Soviet Land—can remain indifferent to their complex, difficult and glorious history. The remarkable labor and combat exploits of preceding generations inspire us to new achievements for the sake of what is most important in the life of Soviet citizens—peaceful, free, inspired labor and our society's persistent progress along the course outlined by the great Lenin.

Air Forces personnel are faced with major and largely complex tasks in the jubilee year. Relying on accumulated experience, Air Forces personnel must elevate their level of professional training and combat readiness even further; persistently master aviation equipment, weapons and tactics; deepen their theoretical knowledge; perfect moral-political, physical and psychological conditioning; and strengthen military discipline and efficiency.

In reflecting on the past and assessing our successes and deficiencies in combat training and the organization and support of flights, one has to note that an important element of training, its military-pedagogic essence, remains in the background in the training process. Frankly speaking, the Air Forces are a branch of the Armed Forces where the requirement for steady improvement and renewal of the training process itself and of training methodologies and the requirement for improving the methods proficiency of commanders who are the organizers of combat training is a constantly operating factor. The continuous development [razvitiye] of aviation equipment and weaponry, the expansion in their range of employment, the search for new tactics, the complex and very contradictory problems of aviation psychology, and the need for developing the qualities needed in a combat situation in personnel under peacetime conditions specifically are those spheres in which the pedagogic abilities of commanders, political personnel, and party and Komsomol activists are displayed most vividly.

The principle that the commander teaches his own subordinate has proven itself well in the Armed Forces, but accepting this principle as fundamental and implementing it in fact are not one and the same thing. Sometimes there is such a gulf between these categories that not every leader can cross it. The military specialist, especially a pilot or navigator, has many superiors: flight commander, squadron commander and his deputies, chiefs of services, deputy regimental commanders and the regimental commander himself. Well, just which one of them above all should train the airman?

Historically it has turned out that as achievements of scientific and technical progress were introduced to the troops and the boundaries of cognition expanded, questions arose: What and how should specialists who must use these achievements with maximum effectiveness be taught? Experience indicates that when no serious thought was given to these matters gaps inevitably appeared in combat training. This was reflected in a similarity of class formats, duplication of topics and methodologies, omission of important problems, loss of interrelationship and continuity, an inclination for theorizing and as a result a detachment from practical work, incomplete use of the capabilities of aviation equipment, and preconditions for flying incidents. This is the retribution which comes without fail as a result of a superficial approach to distributing roles among commanders of different official levels.

It would appear that the principle of the commander teaching his subordinate will produce a real effect only when every leader correctly defines and interprets his place in the operational training process, masters the pedagogics corresponding thereto—the forms, methods and procedures of training and indoctrination—and masters the art of this very important matter through persistent work. Here it should be noted that the higher the commander's official position, the more general are the forms of pedagogic influence on subordinates which conform to his rank. I foresee an objection to the concept of "general forms," but the definition of "general" is not at all synonymous with shallowness, emptiness and formality.

Let us assume that the command training program prescribes a study of air combat lessons. Obviously the regimental commander, squadron commander and flight

commander will teach the pilot this form of combat action. It probably would be incorrect for the regimental commander to hold a run-through with flight pilots on one of the flight mission variants and for the flight commander to give them a lecture. The distribution of roles here is obvious, but it would be absolutely incorrect were the senior superiors to reject small pedagogic forms entirely and become absorbed in lecture classes alone. Such an approach will clearly impoverish combat training.

A regimental commander's lively pedagogic contact with small military collectives and if necessary with individual pilots is fully justified. Here he not only passes on his experience as a combat pilot to flight pilots, for example, but also teaches a lesson in pedagogics to the flight commander. In any case the leader must see and sense what to do when and where, and what method to employ to achieve the desired effect.

An element such as preparation of training materials is of interest in the practice of organizing training and indoctrination. Studies have shown that from 40 to 80 duty hours (in other words, 5-10 days) are spent preparing a two-hour lecture. Looking squarely at the truth, we can say that not one commander has such a time reserve in his daily life, which is filled with flights, exercises and various activities. What if 10-12 lectures have to be given in a year? Unquestionably a good lecture also can be prepared in a shorter time by relying on one's preceding experience, but we can confidently state that quality does not gain from this.

Unfortunately the group method of preparing lecture materials is still rarely used; this produces a high effect both from the methods and the professional standpoint. The method is organizationally more complicated and labor-intensive. Its essence is that the commander assigns a group of officers who are the strongest in theory and practice to elaborate a problem assigned by him (there also can be lieutenants in the group). After a detailed briefing, each one works on a certain question within the framework of the overall idea and provides recommendations. The commander repeatedly corrects his coauthors as work progresses and quite possibly will give some new direction and will seek a format and procedure of presentation suitable for it.

Air Regiment Commander Lt Col B. Tumanov adheres to approximately that methodology. Being well trained in theory himself, he is able to precisely select a topic, arrange the elaboration of individual lessons and assemble them into unified, purposeful material. But however that may be, this still is only a lesson plan. It is very important to bring its content to the awareness of the students and make the presentation lively and connected with flying. Here is where the commander is not afraid to lower the scientific level of the class. A simple, frank discussion with examples from practice concerning flying techniques, tactics, tactical employment or flight safety produces enormously greater benefit than monotonous reading of a lesson plan and unsubstantiated recommendations.

Any aviation collective has officers with high teaching abilities. A rather interesting and one can say delicate question arises: What is the commander to do? Who is to conduct the class in this case? Obviously the interests of the matter and not ambition or formal authority must come to the foreground. It would appear that a good commander who is an intelligent organizer and leader has fully sufficient qualities and his authority will not suffer at all if the class is conducted by a more trained comrade. A commander's lack of lecture ability is excusable, but aviators never forgive something else: useless classes, omniscient airs, and claims to absolute and ubiquitous leadership, especially if such "absolutism" is groundless. It is quite possible that no one will say anything aloud or give any sign, but in their hearts they will condemn and express distrust. This is a substantial loss of authority.

Any class, no matter what form in which it is given, must contain a very definite charge. Formats which have given a good account of themselves are used in training aviators: lectures and seminars, group classroom activities and short training problems, quizzes, simulator training and run-throughs, flights and exercises. All of them have one thing in common—the lesson. No matter how flights differ from lectures or training sessions, for example, they must contain something new. One would like to say thank-you to the instructor when additional knowledge is received or when a person makes a professional discovery for himself, but it also happens that after a class or flight it is impossible to understand where the time went or what new things were acquired. This means that in reality the lesson did not take place and did not work out, and only because it was not given the necessary content.

How can the intended class format be joined with the content so that it is of benefit to trainees and satisfies the teachers?

Ideally each aviator should be taught individually. That is done in flight, for example. With respect to theory, matters are more complicated. Nevertheless, there are opportunities for a harmonious joining of format and content, such as by forming groups not according to the roster, but with consideration of the aviators' qualification, level of knowledge and state of being informed. Here it is important to precisely determine what class format will produce the maximum result in a specific training group. For example, in studying air combat it is advisable to give beginning fighter pilots a lecture filled with theory, to hold a seminar with experienced combat pilots, and to hold a dynamic run-through with masters

of tactical employment. These unquestionably are only variants showing that a commander is required to have much pedagogic expertise in organizing active training.

Frequently the heads of large military collectives use only formats worthy of their high position—lectures, seminars and quizzes—and they rarely hold short training problems in subunits. If they do take part in run-throughs it is only with large groups. There possibly is a certain amount of reason in this, but there are more losses. The first loss is that of experience (training) in using previously mastered training formats. The second loss is the weak (or weakened) feedback with subordinates, which deprives a commander of knowledge about many matters troubling them. The third loss is decreased methods influence on subunit commanders. There are other losses as well. Each leader can perceive them if he will take a critical look at his military-pedagogic practice.

Officer V. Mukhin proved to be a competent mentor for all categories of subordinates. The effectiveness of pedagogics he applies shows up especially in aviators' high combat readiness, in the improvement of crews' tactical proficiency, and in successful resolution of flight safety problems.

In those subunits where commanders do not burden themselves with searching for ways to improve pedagogic proficiency, stereotypes usually predominate in exercises and subordinates allow preconditions for flying incidents and various disciplinary infractions to happen in day-to-day life.

Our flying practice and the life of generations convincingly indicate that experience and qualification come not so much from the quantity as the quality of combat training, from diversity, and from increased complexity of flight assignments.

Take the integration of an assignment for example: a route flight and aerobatics. If a pilot first performs a route flight each time and several aerobatic figures (depending on the type) in conclusion, then integration very quickly loses its methods meaning: the route will turn into the extended occupation of a zone. If we change the order, the teaching effect is obvious: the KPM [flight terminal point] approach, fuel remainder monitoring, choice of optimal route flight regime, and accuracy of maintaining all parameters will be an essential element. This lesson also will have a strong emotional charge.

Military aviation pedagogics more and more often poses questions for command and instructor personnel in the most varied areas of mutual relations with trainees. For example, a pilot makes mistakes in flying a two-seater. How can they be remedied? Should a person correct them himself or offer criticism, lecture the pilot in the air or critique the flight on the ground, offer a friendly suggestion or remove the pilot from flying status? These questions are not as simple as they may appear at first glance. One will hardly succeed in achieving a good result without high pedagogic culture.

Pedagogics always is present where there is contact between commanders and subordinates and between an instructor and trainee. It is especially distinct in aviation where technical characteristics of combat aircraft are connected with the subtleties of the human mind. It is no accident that a pilot's elementary honesty competes in its end effect with results of the work of entire research collectives and of a group of specialists wise in science. The aviator's professional honesty is a very valuable and attractive quality which makes it possible to avoid many mistakes in the future and find reasons for deviations and the true culprits of preconditions. This quality, which has always favorably distinguished genuine air patriots, would be truly invaluable were it not subjected to a test (at times a very severe test) by other qualities and interests. Let us refer to an example.

A gross precondition for a flying incident occurred during group flying teamwork practice by a flight where the first pair leader was the squadron commander, the second pair leader was his political deputy and the wingmen were young pilots, recent flight school graduates. A strange situation arose in the critique of this incident: the flight preparation methodology had been followed and the training level of all its participants conformed to the assignment; in short, nothing unpleasant was anticipated. To the question of how flight preparation had gone, everyone responded that they had prepared to the full extent and practiced actions as prescribed. Inasmuch as the incident had occurred, however, appropriate measures were taken toward those at fault: the leaders were given disciplinary punishment and the lieutenant who had committed the gross infraction was removed from flying status for professional inadequacy.

Then the pilot who had been removed from flying status related (first timidly and then confidently) that flight preparation had been conducted with flagrant infractions: the squadron commander did not practice joint actions with the group; prior to the sortie he merely "stipulated" the procedure for performing the assignment. A question is apropos here: Was it really so easy for the four officer pilots to tell a lie? Probably this was not a simple thing to do, but to display honesty was even more difficult inasmuch as it immediately would have shifted the incident from the category of accidental to the rank of natural and a result of irresponsibility, it would have precisely determined the degree of guilt of each pilot and would have demanded a precise accounting of the superiors above all. This is why all four were silent about the true state of affairs and lied in concert, each for his own considerations. The commanders wished to avoid responsibility and remain in their positions, and subordinates could not "let down" their

seniors. Only a sharp turn in the lieutenant's career forced him to the honest admissions. This is how the best human traits sometimes show up with difficulty.

Just how wise does a commander have to be as a person with one-man command and as an indoctrinator and teacher to ensure that subordinates' high moral qualities always are in a "vigilant" state and that they are displayed not only when it is easy, but also when it is very difficult or superdifficult? This question is not very simple and is rather difficult to answer. One thing is clear: in order for friendly, simple human relationships conforming to the moral standards of our society to be maintained in a collective, the commander himself must be irreproachably honest, carry on high the title of Soviet officer and communist, and show concern not in words, but in action for the people with whom he will go into combat should the situation demand it.

Pedagogic expertise. Frankly speaking, not every commander has it, but he must have it; he is obligated to have it! Otherwise costs are inevitable, with their price, the human life, not subject to any definitions. There is a solution, and not a very difficult one. We must find the time and work with pedagogic literature. For example, books by outstanding pedagogs A. Makarenko and V. Sukhomlinskiy serve well to this day for more than just secondary schoolteachers. Any air commander can find much of benefit for himself in their advice. We have to constantly learn from life, attentively evaluate and analyze each fact of actual reality, and learn from every person (a senior supervisor, a subordinate who has just begun his service) with whom a military career has brought us together. We cannot forget the time-tested air commandments: if you don't know, ask someone who knows; if you can't answer right away, say that you will answer later after you clarify your answer. There is nothing to be ashamed of in this. The person who strives for new knowledge and for culture improves himself, but ignorance and pedagogic helplessness are really disgraceful. Every commander and any potential leader must remember this and constantly work on himself to improve his intellect and pedagogic expertise.

6904

Soviet Space Development Administration Head's Speech at 1987 Moscow International Forum

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No 1 Jan 88 (signed to press 2 Dec 87) pp 4-5

[Article by A. I. Dunayev, chief of Glavkosmos [Main Administration for Creation and Use of Space Technology for National Economic Needs and Research] USSR: "For the Sake of Peace and Progress"; first three paragraphs are AVIATSIYA I KOSMONAVTIKA introduction]

[Text] USSR Glavkosmos, the Main Administration for Creation and Use of Space Technology for National Economic Needs and Research, has functioned in our country since 1985. Its mission includes fuller satisfaction of the growing needs of the national economy, science and international cooperation with space technology resources.

An international forum was held in Moscow 2-4 October 1987 under the motto "Cooperation in space for the sake of peace on Earth" with the participation of scientists, specialists and journalists of many world countries. The forum was timed for the 30th anniversary of the launch of the first artificial Earth satellite. Its participants did not merely indulge in recollections, but spoke of how they see the future development of cosmonautics and relationships among people on the planet today from the aspect of three decades of experience in space development.

Chief of Glavkosmos USSR A. I. Dunayev spoke at the forum's plenary session. We are publishing his speech with additions made by the author.

The course set by the CPSU for accelerating the country's social-economic development, new political thinking permeated by a realistic view of the complicated and diverse modern world, successes of Soviet cosmonautics, as well as Soviet space research and development initiatives are factors which are drawing more and more attention of the planet's peoples to the Soviet Union. We saw this with our own eyes at the forum.

Space is a sphere of mankind's common interests. This presumes international cooperation for solving many global problems in the interests of all nations. But today the world is faced with a dilemma: What direction will the development [razvitiye] of cosmonautics take—the path of implementing the "star wars" program and anxiety, or the path of peaceful development of space and hope?

Our course lies toward a peaceful space. This is not a sign of weakness, as some western ideologs love to say. It is a reflection of the Soviet Union's peaceable foreign policy.

Thirty years of experience in the development [razvitiye] of cosmonautics have shown that this field is capable of producing outstanding results in science and technology, but that is not enough today. The time has come to shift more boldly from experiments and test projects to the planned adoption of many achievements in national economic practice. This requires broader cooperation of ministries and departments with the objective of more effective resolution of social-economic tasks: a build-up of productive forces; support for the output of fundamentally new, highly technological kinds of products; and a reduction in expenses for accomplishing sectors' objective tasks by rejecting traditional solutions.

Manned and automatic spacecraft widely used by the Soviet Union already have produced appreciable results. For example, a survey of the Earth's surface performed

with the help of the stationary MKF-6M and KATE-140 cameras of the Salyut-6 and Salyut-7 stations provided an overall economic effect of around R100 million. An even greater effect is expected from the Mir station's on-board gear.

Using satellites of the Kosmos and Meteor-Priroda series along with orbital stations and establishing a constantly operating state space system for studying natural resources provide an opportunity to use the resulting materials to accomplish hundreds of types of scientific-production tasks. The potential economic effect from using space photographs in geology, agriculture, water management, forestry and fisheries can be around one billion rubles per year in the near future.

With respect to the return in geology, the economic effect here comes from increased likelihood of discovering new deposits. Even now specific expenditures for regional geologic work using space photographs have dropped 15-20 percent.

In agriculture space data can be used for forecasting the harvest, making an inventory of lands, monitoring the status of plantings and progress of agricultural work, and providing an early diagnosis of plant diseases and the spread of pests.

The principal area for using space photographs in water management is the creation [sozdaniye] of cartographic materials having a land reclamation slant for substantiating technical decisions for designing water management projects; this will provide an opportunity for reducing field survey expenditures by 2-3 times and substantially improving project quality.

To study the little-investigated part of the country's forest resources in an area on the order of 500 million hectares by traditional methods it is necessary to spend around R300 million and bring in an additional 4,000-5,000 engineering-technical personnel, but using space methods permits reducing the amount of physical inputs and gaining time. The use of space technology has shown its effectiveness in current monitoring of the status of forests and detecting forest fires.

Space photographs contain great opportunities for identifying and evaluating ocean bioproductivity as well as the current status of commercial fishing zones.

On the whole it can be said that the use of space resources for studying and monitoring the Earth's natural resources is distinguished by high profitability. In the Soviet Union the profit is five or more rubles per ruble spent for these purposes depending on specific conditions.

Our country launches Meteor series satellites for performing hydrometeorology tasks. Information from these satellites is widely used in preparing weather forecasts, notifying the populace about elemental natural phenomena, and studying atmospheric processes and the climate. Great prospects lie in joint use of the data of Soviet, American, Japanese and West German weather satellites. Along with the tangible practical benefit, this cooperation is an important factor in strengthening international cooperation and confidence.

Our country has had space communications functioning for two decades now; it presently is provided by Molniya, Raduga, Gorizont and Ekran satellites and the Orbita and Moskva earth stations. In the next few years essentially the country's entire population will have the opportunity of using space TV broadcasting. The economic effect from space resources for TV broadcasting to individual areas compared with ordinary relay methods is R180 million per year. Soviet space communications resources also are widely used for serving residents of countries of the socialist community and of a number of other states.

Space navigation equipment provides a substantial benefit for the national economy. It helps to ensure safety of navigation, to reduce running time and fuel consumption, to improve the effectiveness of the commercial fishing fleet, and to accomplish many tasks in the interests of oceanology and geophysics. Today a new Glonass space navigation system is being created [sozdavatsya] in the USSR.

The Soviet Union makes a substantial contribution to operating the KOSPAS-SARSAT international space system designed for locating vessels, aircraft, tourist groups and expeditions in distress. This system has helped save around a thousand persons on the planet as of the beginning of this year.

As we see, in the years which have passed since launch of the first artificial Earth satellite, cosmonautics has developed into an important sector of the national economy. Moreover, its contribution to solving the most important worldwide problems is growing with each year. Nevertheless, we have managed to get out of space only a small part of what it can provide.

Space research projects are becoming more and more costly and each country's resources are not unlimited. This is why we believe that a uniting of countries for using the powerful scientific potential which mankind possesses is a good basis for building up efforts in studying and developing space. Although there are many problems along this path, we hope that they will be overcome.

The process of space development demands an ever broader comprehension of problems arising not only from scientific-technical standpoints, but also from philosophical, ideological and general standpoints. For example, dangerous trends are developing in ecology. Like it or not, man's vital activities are disturbing the

balance which formed in nature over hundreds of millions of years. Here too cosmonautics could help mankind take steps adequate to the existing situation and direct events into the channel necessary for earthlings.

The USSR Main Administration for Creation and Use of Space Technology for National Economic Needs and Research devotes much attention to solving fundamental and urgent problems on Earth and in space, also with consideration of commercial interests of course. Space is an area where not only international cooperation, but also mutually profitable trade can develop. Proof of this is the interest shown by foreign participants of the "Space and Economics" roundtable discussion at the Moscow space forum.

The geography and number of trading partners have substantially expanded in recent times. It can be expected that by the year 2000 the entire world community will become a consumer of space products and the volume of space services will grow hundreds of times.

Our country's basic proposals for direct participation in international activities on a commercial basis are the leasing of Gorizont communications satellites, surveying territories of individual countries from space, selling information on remote sounding, using Soviet technological gear to perform work or installing a client's instruments in Soviet spacecraft and orbital stations, and using Soviet booster rockets to launch foreign satellites. It is common knowledge that the Kosmos, Tsiklon, Soyuz, Vostok, Molniya and Proton booster rockets have superb statistics and ensure insertion of a wide range of payloads into practically any orbit.

We provide necessary guarantees for safekeeping of the client's technology and other secrets in performing the work.

I will note that the use of space technology in the interests of the national economy and science and in the interests of international cooperation, including on a commercial basis, is one of the chief aspects of activities of the USSR Main Administration for Creation and Use of Space Technology for National Economic Needs and Research. Being a full-fledged industrial-commercial organization, it solves the entire range of problems mentioned in these areas.

Nothing brings representatives of different states and peoples together as- much as joint work for a noble objective. The international Vega and Phobos projects and flights now of 12 international crews on Soviet space equipment are examples of this. This year two more are planned, with representatives of Bulgaria and France. A protocol has been signed about the flight of a citizen of Afghanistan and the question of the flight of a representative of Austria is being discussed. The Soviet side has opened the doors of cooperation for all countries in a phased study of Mars.

As we see, the Soviet Union not only opened up the space era for all mankind, but also is providing an opportunity for scientists and engineers of many world countries to take part in the peaceful development of space. In the future we will continue a course toward comprehensive assistance to international cooperation in developing and using outer space, including establishment of a World Space Organization and an international center for development and creation [sozdaniye] of space rocket technology resources for developing countries.

One would like to believe that the International Space Year proposed for 1992 will serve as a springboard for our civilization to enter the 21st century as a century of peaceful space.

6904

Squadron Inflight Retargeting Practice Recommended

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[Article by Lt Col A. Zhuravskiy, squadron commander, 1st class military pilot: "Assignment Changed in the Air"]

[Text] The new, more advanced combat equipment coming into the inventory is leaving its imprint on tactics of the combat arms. For example, ground troops have become more mobile and less vulnerable, leading to a frequent change in the tactical situation on the battlefield. This in turn makes it necessary to retarget air crews in the air in a number of cases. Day-to-day combat training shows that this is no simple task; its accomplishment requires a systematic and comprehensive approach.

A group of missile-armed aircraft led by Gds Lt Col E. Dachevskiy was making a range approach during an LTU [tactical flying exercise]. The leader's pair already was on the bombing run when a command came from the CP to destroy another target about which some crews had a very vague impression. Before take-off the aviators had not gone over the details of structuring such an approach for an attack inasmuch as it was not envisaged by the assignment. The pilots were in a difficult position with regard to how the maneuver should be structured and where the new target was located. As a result several crews did not cope with the assignment.

At first glance the reason for the failure is obvious: the aviators prepared for the flight superficially and did not study the target situation on the range; hence the uncertainty in actions on the bombing run. Limiting ourselves only to this conclusion, however, as often was done

earlier means closing our eyes to deep-seated problems in combat training which, frankly speaking, also have remained outside our field of view for so long.

Now when talk is about restructuring management principles and work methods, we have to take a more exacting look at the entire system of preparing flight personnel for flights. Take mission assignments, for example. As a rule, crews are given the name of the target and a reference point near which the target is to be sought. A mission was assigned in approximately that same way to pilots back during the Great Patriotic War, but the fact is that now we are flying aircraft equipped with good on-board computer systems. Why not transmit not only the name of the target and the reference point near which it is located, but also its geographic coordinates from the command post to the missile-armed aircraft? Search time for a given reference point and strike objective thus will be shortened, which will preclude the possibility of an inaccurate determination of coordinates and their input to the computer. The work of navigator-programmers will be simplified considerably if coordinates are known on the ground in the flight preparation period. The winner in the final account is combat readiness.

The navigator plays the primary role in retargeting a crew in the air. The faster and more accurately he acts, the easier it is for the crew to execute the assigned mission. But this is on one condition: the mission must be assigned to the crews in the air at least several minutes before the strike. We have to bear in mind here the displacement of aircraft in the horizontal and vertical planes of attack in the direction of the given target, decisionmaking, input of data to the PNK [aiming and navigation system] computer, the possibility of assembling or breaking up the group, the approach to base reference points at the given time and the attack run. Since flights and pairs may attack a given target from different directions when retargeted, tactical procedures must be worked out in advance during flight preparation. In the tactical flying exercise it remains for the group leader only to clarify certain details. This relates directly to ground control of the crews, especially when representatives of ground forces take part in the control. In this regard I would like to emphasize that aircraft in the air are not tanks on the ground and so commands such as "Squadron, halt! Tank 3 km to the left!" are unacceptable for us aviators. This would appear to be obvious, but it is often forgotten.

Maj V. Ponomarev's squadron was participating in an exercise jointly with ground subunits. The aviators were assigned the mission of delivering a strike against the "enemy" forward line at the spot of a proposed tank battalion assault. The crews took off at the designated time and the missile-armed aircraft approached the target at extremely low altitude. After the flights and pairs diverged a swift attack followed. The next pass also was no less effective.

"Good lads!" came the exercise director's voice over the air.

After landing at their airfield the aviators began preparing for the next sortie without delay. Maj Ponomarev phoned the CP in an attempt to get information from representatives of combined-arms subunits about a change in the tactical situation on the battlefield, but in vain. The aviators' problems meant nothing to those representatives, to put it mildly.

Then the squadron again took off and flew the previous route. The "enemy" anticipated that variant: the bombers' path was blocked by ZRK [SAM systems] and fighters. After penetrating air defense, the crews began to copy the first sortie's attack and it was only at this point that the command for retargeting came. Naturally one could not expect high results of a strike under those conditions.

Just why was there such a lack of coordination which essentially nullified the aviators' efforts? There were several reasons for this.

First of all, those at the ground forces CP took an irresponsible attitude toward organizing coordination with the flight crews. Apparently it was all because responsibility for air support basically is borne by the air commander, who essentially almost has to offer his services.

Secondly, the combined-arms subunit representative at the PNTs [vectoring and target designation post] did not take into account that the group leader needed time for a situation estimate and decisionmaking. The narrative problem came at the moment when the aircraft already had begun to dive. Had the command come earlier when the combat formation had not yet split up for the attack, Maj Ponomarev would have succeeded in changing the point for beginning the group's split-up, which means the flight model scrupulously calculated on the ground would have been preserved.

Thirdly, the tactical situation at the range had changed considerably when the bombers approached the strike area in that the troops' line of contact had shifted several kilometers eastward, but no one had gotten around to warning the aviators about this in advance.

The pilots of course also deserve reproach; they must always be ready for a change in the battlefield situation. Nevertheless, in my view the commanders for whose subunits the aviators were working are at fault to a greater extent. It is high time to understand that under present-day conditions the competency of the combined-arms officer, especially the commander, consists of more than having a good knowledge of ground force tact cs.

The retargeting of crews also is done from the air by those who perform final reconnaissance of the target. Much here depends on the objectivity and precision of

the information they provide. Suffice it to say that a 200 m error in determining coordinates of the strike objective threatens mission accomplishment. Meanwhile experience indicates that one of the basic problems for nonregular aerial reconnaissance personnel is an accurate determination of the location of new targets and rapid transmission of data to the crews of strike groups. Hence the conclusion that all flight personnel must be taught the expertise of performing aerial reconnaissance, and not occasionally, but regularly and purposefully.

I have become convinced from my own experience that when there is a change in the situation in the air, great importance lies not only in professional training, teamwork and conditioning, but also in high moral-psychological training of flight personnel. An analysis shows that sometimes inadvertences committed by pilots in flight are a consequence of their self-complacency. I will cite an example from the combat training practice of our subunit's aviators.

During a tactical flying exercise we were assigned the mission of supporting an attack by an amphibious assault force. In particular we had to deliver a strike against a fortified "enemy" coast defense line. The weather was excellent in the vicinity of the airfield and weather forecasters gave a forecast that weather conditions would not change in the near future along the entire route and in the vicinity of the target.

After take-off the squadron assembled in a close combat formation and set a heading for the target. Alas, the forecasts by our meteorologists were not borne out. The closer we approached the strike area, the worse the visibility became. I ordered the crews to split up, but there was not enough time for them to be able to assume a combat formation which would support a strike in adverse weather conditions. As a result we did not execute the mission completely.

In essence we were let down by complacency. Having counted on easy victory in the practice action, we estimated the weather situation superficially and did not work out in advance our actions if it worsened. In addition, tactical principles of conducting combat actions under adverse weather conditions were violated.

We concluded from this incident that by making narrative problems more complicated from sortie to sortie we had to achieve a situation where implementation of the retargeting concept would become possible under all conditions. To ensure this our flight commanders began to hold more purposeful simulator training on the gear and by the dismounted flight training method, they improved the effectiveness of short tactical training problems, and they prepare and critique flights in more detail under the tactical flight training plan. In relying on an intensified training process we not only count on remedying the subunit's deficiencies, but also on taking an essential step toward new milestones of military proficiency.

6904

Combat Pilot's Career Detailed

91440067d Moscow AVIATSIYA I KOSMONAVTIKA in Russian
No 1 Jan 88 (signed to press 2 Dec 87) pp 10-11

[Article by Col Ye. Besschetnov: "His Three Orders"]

[Text] Aviators of different generations arrived for a meeting in the USSR Armed Forces Central Museum film lecture hall. Although Military Pilot 1st Class Maj A. Porublev, a student of the Air Academy imeni Yu. A. Gagarin, spoke following famed pilot and HSU Col Gen Avn G. Dolnikov; Col Gen Avn G. Baydukov, a participant of the heroic flight over the North Pole; former test pilot Col (Res) Yu. Antipov and others, he too was listened to with great interest. Porublev spoke about the courage and valor of aviators of new generations who replace frontlinesmen in Army formation and about combat sorties of his comrades in the menacing sky of Afghanistan where he had occasion to perform military and international duty. The pilot himself also drew attention as an individual. Porublev had served a little more than ten years, but already had been decorated with three orders.

When the meeting ended Aleksandr and I retired to a room next to the hall and got into a conversation. We had become acquainted earlier, and now I was interested in how life was going, how he was performing his duty and for what he had received the Motherland's high awards. Aleksandr Fedorovich had something to tell about.

Three adobe huts enclosed by a high duval [?wall] loomed gray next to the road in the haze below on the floor of the Panjshir Gorge. Judging from intelligence, it was here that the heads of several dushman bands had gathered to discuss a plan for new joint attacks against the people's power. Deputy Squadron Commander Maj A. Porublev who headed the flight of attack aircraft commanded his wingmen to prepare and swooped into the attack out of a turn. He placed the dot of light on the sight glass on the target, the middle hut, and as soon as the aiming-navigation system produced the necessary data he pressed the firing button. The wingmen also did this after him. The released bombs flew toward the ground.

Before the bombs exploded Porublev suddenly sensed an unknown force which drew the aircraft to the left in such a way that he barely kept it from a dangerous turn. In heading for the assignment the pilot assumed that the heads of the bands unquestionably had seen to their security. In fact dushman heavy-caliber machinegun crews had immediately fired on the flight in an attempt to create a screen of fire, but Aleksandr Fedorovich did not understand what had happened to the aircraft.

Porublev shifted the attack aircraft into level flight with difficulty. Exiting the danger zone, he took a look at the left surface and saw something unusual: a rather bulky suspended fuel tank with fuel had torn from its attachments, had hung up on one of the pylons and had taken an upright position crosswise to the air stream. This is what caused the large turning moment.

Porublev transferred leadership of the group to his wingman, Squadron Chief of Staff Maj I. Chmil, reported the situation to the flight operations officer and set a heading for the airfield. His comrades in arms cut speed and pulled back a bit, ready in case Porublev ejected to form a circle over the spot where he landed and give him reliable cover until search-and-rescue support helicopters arrived. The deputy squadron commander applied incredible effort and continued to keep the aircraft in the air and on its previous heading. His hands and legs were getting more and more numb with every passing minute. When the concreted runway appeared the pilot already had begun to seriously fear that he would not have the strength to keep the aircraft from turning. But the landing was ahead. Was it possible? Perhaps he would have to abandon the aircraft.

"Will you be able to simulate the landing?" queried the flight operations officer.

"It's dangerous, but I'll try."

"Don't land yet. Pass above the runway, have a look, and then make a second circle!"

Applying all his effort, Porublev placed the attack aircraft on a landing heading and took up the glide path for the descent. Flight Operations Officer 1st Class Military Pilot V. Voronkov watched his actions continuously. The group's pilots who had accompanied the commander's aircraft now were circling the flying field.

The test landing approach seemed to have worked. The flight operations officer authorized Porublev to land the aircraft on the second pass.

It was difficult, unbelievably difficult, to land a heavy aircraft which was constantly trying to turn, side slip and crash to the ground, but Maj Porublev emerged from this difficult situation with honor. He proved stronger than the circumstances and managed to land the aircraft safely.

The incident which occurred with him is extremely rare in aviation in the specialists' opinion. It became possible only with the confluence of a number of circumstances. An analysis of the causes showed that at the moment of the attack the suspended tank pulled from its attachments from a bullet hit; filled with fuel, it somewhat outstripped the aircraft from inertia and then hung up on the pylon in a vertical position. The pilot naturally was not prepared for such a turn of affairs. Nevertheless, having gotten into the unusual conditions, he coped with the handling and saved expensive equipment.

Serving as part of the limited contingent of Soviet troops in Afghanistan, by this time Maj Porublev had flown more than a single group of ten combat sorties to deliver crushing strikes against dushman weapon and ammunition depots and rebel strongpoints and firing positions. His actions earned high praise. Maj Porublev was decorated with the Order of Red Star.

This was his second award. The officer received the first one a year ago during service in the Red Banner Odessa Military District.

After completing military aviation school six lieutenants, six young pilots, arrived at a new duty station. Regimental Commander Lt Col V. Sidorenko and Political Department Chief Lt Col V. Shestakov automatically gave special attention to Porublev on becoming acquainted with the novices. His comrades lieutenants A. Rassolov, V. Apalkov, B. Gurin, V. Golovach and N. Zverev also had received high marks in state exams, but Porublev finished school with honors. His graduation performance appraisal contained many kind words.

Porublev has more than enough diligence and persistence. The unit command element's hopes for the promising young pilot were borne out. In a year he was appointed senior pilot and in two years flight commander, first among contemporaries to be advanced to that position. Apalkov and Zverev came into his flight.

Aleksandr Porublev had learned a great deal while serving in Capt V. Kochigin's flight, and now the recent pupil challenged the teacher to competition. According to the results of that rivalry, victory often was awarded to Porublev's flight. It happened that his flight was first in the regiment to begin mastering higher aerobatics in a high-speed fighter. In addition, it performed alert duty precisely and had high indicators in tactical employment.

This was an interesting, unique time. The position of flight commander was not just a rung on the career ladder for Aleksandr. Its importance lay elsewhere: he had an enormously deeper understanding of what aviation and its purpose were and what his personal role was in accomplishing the missions at hand. He passed exams for a 1st Class rating and received authorization for instructor flights. He not only took up young pilots who recently joined the squadron in the two-seater, but also his comrades from school. It is true that their level of flight training also was high; Porublev would teach them some things and they would teach him some things. As a result the flight confidently climbed in military training.

There was a strict commission, the USSR Minister of Defense Inspectorate, present in those tactical flying exercises. The command came for the take-off. A pair took off into the cloudless sky to intercept a radio-controlled target and a parachute target. The attack line was already near.

The target was ahead. It turned out that it was maneuvering vigorously. Nevertheless pair leader Lt Col Shestakov launched a missile at the optimum distance after locking onto the target. As soon as the radio-controlled target fell in bits a parachute target separated from it. Now it was Porublev's turn to do some work. It was not an easy task. The distance to the target swiftly shortened. There was extremely little time for aiming but Aleksandr Fedorovich managed to get it in the sight quickly and deliver an accurate strike.

Commission members evaluated this pair's work with the highest mark.

By the way, all flight pilots distinguished themselves in performing other assignments. Capt Porublev was rightly named among the best officers of the regiment when results of the LTU [tactical flying exercise] were summed up.

Aleksandr commanded a flight for three years. He proved to be a capable mentor of subordinates and was appointed deputy squadron commander. The scope of the officer's activities expanded, especially since the squadron soon began retraining on what was for it new aviation equipment—a jet attack aircraft outfitted with the latest equipment. A difficult task arose for the collective. There were no instructor pilots or operational trainer aircraft—only combat aircraft. Moreover, it was difficult to break the habits and psychology of fighter pilots and requalify them as attack pilots.

A heavy burden fell on Porublev's shoulders. Aleksandr Fedorovich worked on himself a great deal. Together with the squadron commander and his political deputy, Porublev resolutely strove for "compacting" the training time. It was not without their influence that the personnel thoroughly and genuinely understood how important it was to master what was for them new equipment in compressed time periods. The people labored, also sparing no effort. They worked long and hard, far from home at a different airfield.

After retraining in an extremely short time period, Porublev was one of the first to make a solo flight in the attack aircraft in August 1983. Soon other squadron pilots also began flying the new aircraft confidently. Many of them not only retrained but prepared for 2d Class exams while flying the new equipment, which is very noteworthy. Substantial credit for this also goes to the deputy squadron commander. Porublev was recommended for his first award, the Order "For Service to the Motherland in the USSR Armed Forces" 3d Class, which was presented to him in a ceremony on the eve of the Soviet Army and Navy anniversary.

Maj Porublev received his third state award, the Order of Red Banner, right here in the Air Academy imeni Yu. A. Gagarin. To the question of why he received this order, the pilot responded:

"I think it was for everything I managed to do in performing international duty."

He has several hundred complicated, difficult flights in the formidable Afghan sky to his credit. He can't recall all of them, but one especially cut its way into his memory.

The dushman had occupied dominant heights at the entrance to the Panjshir Gorge and as soon as our motorized riflemen moved along the only road here the dushman began to fire on them from machineguns from above. The dushman pressed them so that the motorized riflemen could neither push forward nor withdraw. The aviators' assistance was required. Maj Porublev and Capt V. Annyuk were on duty at the airfield at this time and the command post scrambled them.

The sun floated high above his head, flooding the ground with blinding light. The peaks of snow-covered mountains rose off on the horizon. There was the entrance to the gorge. As leader, Porublev established radio contact in advance with the forward air controller located in the motorized riflemen's column. The latter informed him where and on what heights the dushman were lodged. Had the day been overcast it would have been possible to determine where the bandits were firing from more accurately from the flashes of rounds, but today it was so bright that flashes were not visible at all. Porublev acted in precise accordance with the forward air controller's commands in hopes that this would ensure success. Although he was sure he would be able to bracket the dushman fire teams, he still could not determine how accurately he himself dropped bombs on the nearest peak, or how accurately his wingman dropped them on the neighboring peak. They struck and returned to their airfield.

It was only a few days later that information came in confirming that the strike had been effective and that the pair had performed the necessary work. The bandits immediately ceased fire and the motorized riflemen were able to advance to their destination without losses; later they performed their assigned mission excellently.

The command element of ground subunits in whose interests Porublev and his groups had operated more than once even earlier petitioned for him to be recommended for a state award. Some time later a third order decorated the officer's chest.

***

Maj Aleksandr Porublev is from a working family. His father Petr Stepanovich was an electrician for a long while. In recent years he has been a foreman in the Sevkavgazmontazh Association in Stavropol Kray. His mother Valentina Danilovna worked as a handyman and now is on pension.

It was Aleksandr's long-time dream to become a military pilot. After entering the Stavropol Higher Military Aviation School for Pilots and Navigators of Air Defense, however, he became involved in circumstances which it seemed would separate him from the sky forever. On performing his very first parachute jump he landed poorly and broke his left leg in three places. While he was hospitalized his classmates were advancing further and further in the program. When Aleksandr returned to school they had succeeded in mastering a great deal. It seemed he had lagged hopelessly behind them. The question arose of whether or not it made sense to remain in school.

The lad's heart was heavy. Was his dream really not destined to come about? In this difficult period Col A. Davydov, chief of the aircraft and engine chair; Lt Col V. Zakharov, an aviation equipment instructor; Platoon Commander Capt A. Pleshkov and other officers offered Porublev enormous moral support. They took a most lively part in the cadet's further career. In the end the school command element's conclusion reduced to the following: Let him continue studies; the flying profession is complex and it will determine for itself whether or not he is to be a pilot or should seek another occupation.

Aleksandr had to tackle studies vigorously and make up for lost time. Later he even outstripped many of his contemporaries and finished school with honors.

Instructors Capt V. Kozitskiy and Sr Lt V. Maksimovskiy and in the combat regiment commanders lieutenant colonels A. Ivanov, Ye. Mikhaylov and N. Shapovalov, political officers majors V. Tkachenko and A. Karpushin, and Deputy Squadron Commander Maj V. Stasyuk helped in his development. Later after becoming a genuine master of his work, Maj Porublev himself did a great deal to develop his subordinate pilots. For example, along with flying combat sorties in the DRA [Democratic Republic of Afghanistan], he frequently flew as instructor. It was thanks to him that captains Ye. Pekshev, V. Butorin, Yu. Zubkov and others gained necessary combat experience. They pounded the dushman boldly and resolutely.

Appearing at the meeting before aviators of different generations, party member Maj A. Porublev could speak with good reason on behalf of those who had replaced the frontline aviators in the winged formation. He has a moral right to this, the right given him by combat experience and the high state awards received for exemplary service to the Motherland and for allegiance to his military and international duty.

6904

Importance of Developing Good Landing Habits

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No 1,Jan 88 (signed to press 2 Dec 87) pp 15-16

[Article by Col V. Neuchev, 1st Class Military Pilot: "In the Final Flight Phase"]

[Text] The prelanding glide following the far nondirectional beacon. It can be said without exaggeration that this element of the flight probably is one of the most difficult and one that reveals a pilot's degree of preparedness: his self-control, coordination of movements, cleanness of flying techniques, and ability to allocate attention correctly. This is easily understood, for during some 40-50 seconds the combat pilot performs over 50 different operations, each of which demands extreme precision of actions. As we see, this is no small load. Experience shows that not all young pilots succeed in coping with it in an identically successful manner. I recall the following episode.

Once in the squadron where 1st Class Military Pilot Maj Kh. Kravchuk serves, an instructor noticed that Sr Lt I. Voronko was unskillfully fighting drift on the glide path during a landing and was allowing large lateral oscillations and banks and frequent realignments with the runway. It is not surprising that the officer sometimes received poor marks for a sortie although he bombed and fired well.

Flight Commander Capt Ya. Yevsikov thoroughly studied the reasons for these mistakes by his subordinate and concluded that the pilot was incorrectly allocating attention and could not precisely catch the moment for shifting from instrument flying to visual-instrument flying. It was necessary to do some work with him. Soon Sr Lt Voronko firmly mastered the procedure of working with cockpit accessories and felt more confident on the glide path.

Just what are the features of flight on the prelanding glide? There are several, but in my view the principal one is the pilot's concentration and mindset. The officer has to ask himself the question "Am I ready for the landing?" right when he takes up the runway heading. At this moment it is important for the crew commander to have a precise idea of the landing weight with which he is approaching the airfield and accordingly what rpm he has to maintain for a correct descent. In addition it is necessary to know the wind force and direction, air humidity, atmospheric pressure, temperature and other data without which it is inconceivable that an accurate calculation can be performed.

Of course flight personnel receive all these data in the process of preflight preparation. Officers take them into account in advance and think through their actions even before getting into the cockpit. At times, however, it also

happens that a crew is en route and weather conditions in the vicinity of the airfield begin to change intensively. At such moments crew members have to reorganize their thinking quickly and solve various hypothetical problems, which often affects the precision of their actions.

The aircraft was coming in for a landing. A young pilot and an experienced instructor were in the cockpit. Nevertheless, the aviators were preoccupied with calculations for a certain instant after one of the commands from the flight operations officer. The pilot mechanically reported that the landing gear had been lowered and green lights were lit. In reality the landing gear was retracted and only after a repeat command from the control tower did the crew lower the gear.

Essentially just what happened? An outside action suddenly entered the pilot's customary movements and dislodged him for some instant from his train of thought. He already reported lowering the landing gear seemingly automatically as he thought about his next actions. It was all because the officer's habit was not firm and a stereotype of movements was not fixed in his awareness.

Experience convinces us that to keep this from happening pilots and navigators must persistently prepare for each specific flight assignment and play out their actions literally from take-off to landing. A flight commander has to talk with subordinates in detail and check their knowledge about the aircraft's behavior with particular movements of the controls.

Simulator gear provides substantial help to pilots in developing a dynamic stereotype of actions on the landing heading. Sometimes one can only be surprised at how some officers ignore simulator classes on the erroneous assumption that work on simulators cannot be compared with real flying. But the experience of foremost aviators majors V. Voskoboynikov, I. Gorelskiy and N. Demyanov, captains A. Sushnik, N. Dobronravov, S. Cheskidov and others persuades us that the number of classes on special gear and then in the cockpit of missile-armed aircraft is transformed without fail into quality and helps one get rid of mistakes and fly a supersonic aircraft confidently and stably under all weather conditions.

The important thing for the flight commander is not to allow a pilot to assimilate an incompetent movement or allow a mistake to become rooted. As we know, the fact is that it is much more difficult to relearn something. This is why there has to be a detailed analysis of each flight using objective monitoring data. For example, Flight Commander Capt N. Loskutov constantly uses the data of monitoring and recording gear in his work with subordinates. Before a particular pilot's next sortie he has a precise idea where an error was made in a previous flight and tries to have a thorough talk with a subordinate and explain the reason for a mistake.

Capt Loskutov also believes visual observation is not superfluous for himself, especially in the vicinity of the runway control point where irregularities in flying techniques are spread out for all to see. He will stop, take a look and make notes in his notebook. Then he has a specific chat with subordinates using diagrams and aerodynamic formulas or simply a model of the missle-armed aircraft. The fact that pilots of his flight fly confidently and make enormously fewer errors than others is seen as quite natural.

The marker beacon bell went off signifying overflight of the far beacon. Here is where some pilots try to pick out the landing strip, and here is where many make a mistake. The pilot places the aircraft nose on the center of the strip and observes the strip, but with a cross wind the aircraft displaces to one side. The pilot fights drift oblivious of other instruments (altimeter, air speed indicator), and he permits an early descent, which already is dangerous.

In my view, development of psychological qualities during flights in adverse weather conditions also is of no small importance. Even brilliant flying techniques will be worth little if a pilot begins to act nervously and uncertainly for the slightest reason. It is the simulator that permits polishing character, for during simulator training one can give any number of the most difficult hypothetical situations; in solving them the pilot learns to overcome doubt, uncertainty and indecisiveness and tempers his will. It would appear that this very thing should be practiced during flights in operational training aircraft, but within reasonable limits ensuring safety. A firm and confident flying trademark is developed when a pilot regards every flight with all seriousness.

6904

Parachute Landing Evaluation with Programmable Microcalculator

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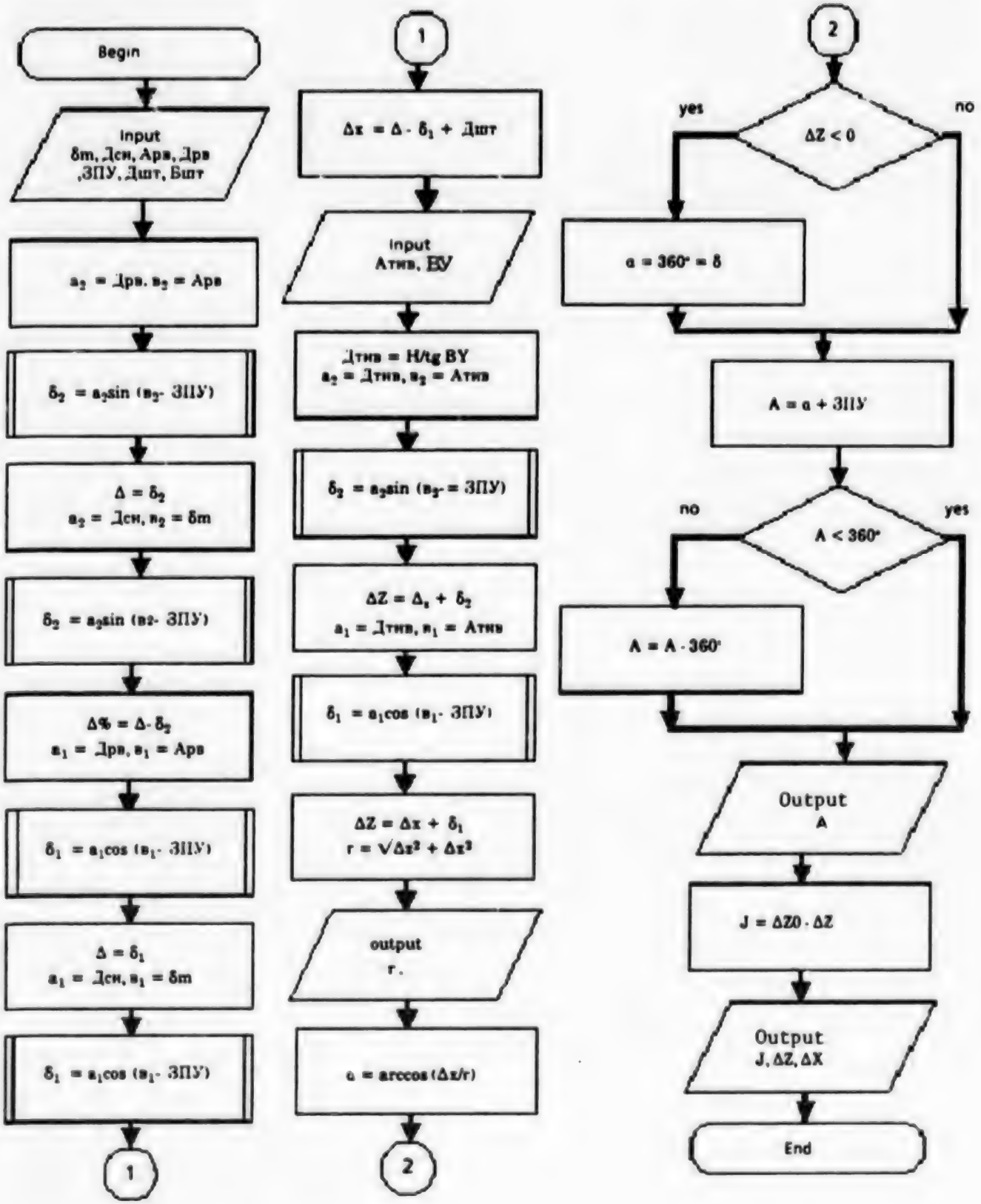
[Article by Lt Col V. Cherepanov, military navigator-sniper]

[Text] The practice of parachute-landing flights often precludes the presence of a flight operations officer in the zone for monitoring and evaluating aircraft crew actions. In these cases it is necessary to resort to graphic calculations of the coordinates of the actual drop starting point relative to the desired point. The essence of such calculations is as follows.

The drop zone and position of the drop officer in charge [OIC] are plotted on the map (see figure). A distance equal to the first parachutist's drift during the descent is laid off opposite the wind from his calculated landing point. From this resulting point the amount of the parachutist's deviation from the drop starting point under calm conditions to the final main parachute deployment point is laid off on a reverse heading to the desired course for the aircraft drop approach. The point thus plotted is taken as the desired drop starting point.


Begin
Input
δm, Дсн, Арв, Дрв
,ЗПУ, Дшт, Бшт
a2 = Дрв, в2 = Арв
δ2 = a2sin (в2- ЗПУ)
Δ = δ2
a2 = Дсн, в2 = δm
δ2 = a2sin (в2- ЗПУ)
Δ% = Δ- δ2
a1 = Дрв, в1 = Арв
δ1 = a1cos (в1- ЗПУ)
Δ = δ1
a1 = Дсн, в1 = δm
δ1 = a1cos (в1- ЗПУ)
1
1
Δx = Δ - δ1 + Дшт
Input
Атнв, БУ
Дтнв = H/tg БУ
a2 = Дтнв, в2 = Атнв
δ2 = a2sin (в2- = ЗПУ)
ΔZ = Δ2 + δ2
a1 = Дтнв, в1 = Атнв
δ1 = a1cos (в1- ЗПУ)
ΔZ = Δx + δ1
r = √Δz² + Δx²
output
r.
α = arccos (Δx/r)
2
2
yes
ΔZ < 0
no
α = 360° - δ
A = α + ЗПУ
no
A < 360°
yes
A = A - 360°
Output
A
J = ΔZ0 - ΔZ
Output
J, ΔZ, ΔX
End

Parachute landing diagram

Key:
1. Drop OIC
2. Drop zone
3. Calculated landing point of first parachutist
4. Desired drop starting point
5. Actual starting point
6. Calm landing point of first parachutist

Aircraft crews usually make errors in approaching this point; to determine the errors the drop OIC uses a theodolite to intersect the aircraft's location at the moment the first parachutist separates (or at the moment a conventional signal is given), measuring the vertical angle and azimuth of the location. From the vertical angle and known drop altitude he determines the distance to the actual drop starting point. The actual drop starting point is plotted on the map from the drop OIC's location according to azimuth and distance. Deviations in distance and direction, and the azimuth and radial error are measured relative to the desired drop starting point. The error in range and the actual interval are determined for wingmen.

A programmable microcalculator can be used to quickly perform analytical processing of parachute landing results. Errors in range and direction as well as the actual interval of the wingman are calculated using the following expressions:

$$\Delta X = (H/\operatorname{tg} B\Psi)\cos(A_{\Pi\Pi} - \Pi\Pi\Upsilon) + \\ + \Delta_{cB}\cos(A_{cB} - \Pi\Pi\Upsilon) - \Delta_{\Pi\Pi}\cos(\delta_{\Pi} - \\ - \Pi\Pi\Upsilon) - \Delta_{BT},$$

$$\Delta Z = (H/\operatorname{tg} B\Psi)\sin(A_{\Pi\Pi} - \Pi\Pi\Upsilon) + \\ + \Delta_{cB}\sin(A_{cB} - \Pi\Pi\Upsilon) - \Delta_{\Pi\Pi}\sin(\delta_{\Pi} - \\ - \Pi\Pi\Upsilon) - B_{BT},$$

$$J = \Delta Z_{\Pi\Pi} - \Delta Z_{\Pi\Pi}$$

Radial error and azimuth are determined from the formulas:

$$r = \sqrt{\Delta X^2 + \Delta Z^2},$$

$$A = \Pi\Pi\Upsilon - \arccos(\Delta X/r) \quad \text{при } \Delta Z \geq 0,$$

$$A = \Pi\Pi\Upsilon - 360 - \arccos(\Delta X/r) \quad \text{при } \Delta Z < 0$$

where H is the drop altitude; ВУ, $A_{\Pi\Pi B}$ is the vertical angle and azimuth of the aircraft at the actual drop starting point; $Д_{cB}$, A_{cB} are the polar coordinates (distance and azimuth) of the drop OIC's location relative to the first parachutist's landing point; $Д_{CH}$, δ_{H} is the parachutist's wind drift and meteorological direction of average wind in the descent layer; $Д_{BT}$, ЗПУ is the amount of deviation of the drop starting point from the final main parachute deployment point (tabular amount or as measured by the drop OIC) and the desired track angle of the drop run; B_{BT} is the lateral displacement of the drop starting point.

The function arccos (X) is determined in the programmable microcalculator within the limits of 0-180°.

On closer consideration of relationships for determining the errors of approach to the drop starting point in distance and direction we can note that they contain repetitive expressions $\delta_1 = a_1\cos(B_1 - ЗПУ)$, $\delta_2 = a_2\sin(B_2 - ЗПУ)$, which can be separated out into individual subroutines. With consideration of this, the algorithm diagram will appear as shown in the figure and the corresponding program will have the appearance:

```
00 ИП6  01 ИП5  02 ПП   03 82  04 ИП4
05 ИП3  06 ПП   07 82   08 -   09 ИП9  10 -
11 ПА   12 ИП6  13 ИП5  14 ПП   15 87
16 ИП4  17 ИП3  18 ПП   19 87  20 -   21 ИП8
22 -    23 ПВ   24 С/П  25 =   26 Ftg  27 +
28 ПД   29 =    30 ПС   31 ПП   32 82  33 ИПА
34 +    35 ПЕ   36 FX²  37 ИПД  38 ИПС
39 ПП   40 87   41 ИПВ  42 +   43 ПЕ2  44 FX²
45 -    46 F√   47 С/П  48 ИП2  49 =   50 +
51 Farccos 52 ИПЕ  53 FX<0 54 63  55 ГО
56 3  57 0  58 0  59      60 /-/  61 ВП  62 04
63 ГО   64 ИП7  65 +   66 3  67 6  68 0  69 -
70 FX<0  71 74  72 FB√  73 +   74 С/П
75 FX=0  76 24  77 ИП1  78 =   79 -   80 ВП
81 20  82 ИП7  83 -   84 Fsin  85 ×   86 В/О
87 ИП7  88 -   89 Fcos 90 ×   91 В/О
```

Instructions:

1. F ПРГ, switch Р-Г into Г position, load program, F АВТ.

2. Input source data that are constant for specific parachute landing conditions: δ_H (degrees) into П3; $Д_{CH}$ (meters) into П4; B_{BT} (meters) into П9; A_{cB} (degrees) into П5; $Д_{cB}$ (meters) into П6; ЗПУ (degrees) into П7; $Д_{BT}$ (meters) into П8.

3. В/О; С/П, intermediate result--the number describing constant parachute landing conditions--into register X.

4. Load data which changes during the parachute landing into registers X, Y and Z: A (degrees), ↑, ВУ (degrees), ↑, H (meters).

5. С/П, r (meters) into register X; С/П, A (degrees) into register X; ΔZ (meters) into register П1; ΔX (meters) into register П2.

6. Load 0 into register X (for a lone and leading crew) or the leader's lateral deviation (for wing crews), (meters).

7. С/П, J (meters) into register X--wingman's interval relative to leader.

8. Go to paragraph 4 for calculating another crew's errors.

9. Go to paragraph 2 for calculating errors under other conditions.

Example. Source data: H=1000 m, $_{M}$=300°, $Д_{СН}$=600 m, $А_{ТВ}$=130°, $Д_{СВ}$=1000 m, ЗПУ=255°, $Д_{ШТ}$=+300 m, $Б_{ШТ}$=-300 m.

Intermediate result: Into register X=-1297, 8406 (count time 20 sec); variable source data: $А_{ТНШ}$=283°, БУ=31°, H=1000 m. Leader's lateral deviation 46 m.

Results:

In register X: 236.06888, r=236 m (count time 16 sec);

In register X: 211.63863, A=212° (count time 9 sec);

In register X: -208.0843, J=-208 m (count time 3 sec);

ИП1, in register X: -162.0843, Z=-162 m;

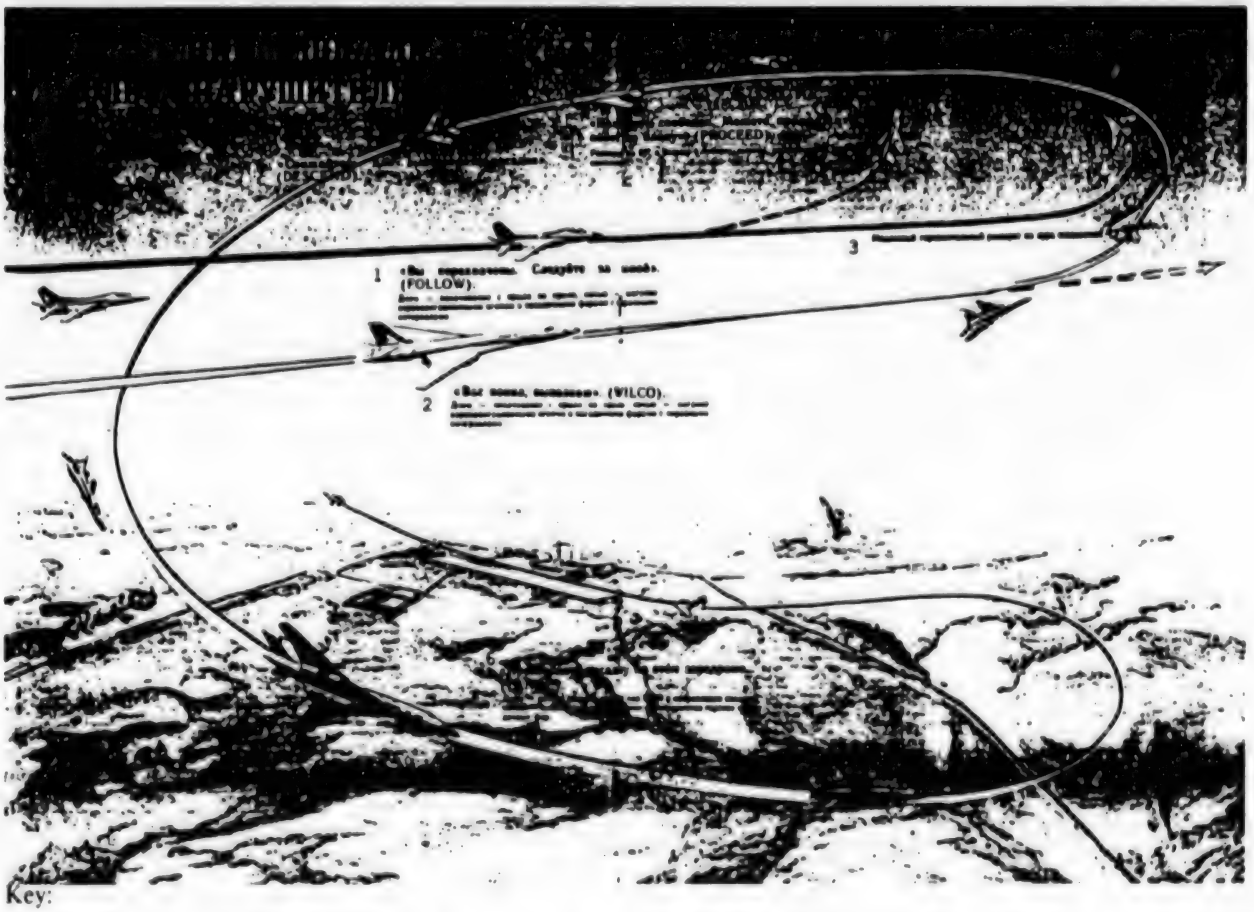
ИП2, in register X: 171.631, ΔX=172 m.

Thus errors of graphic constructions are precluded and the count time does not exceed one minute.

6904

Procedure for Forcing an Intruder Aircraft to Land [Illustration: "Forcing an Intruder Aircraft to Land"]

91440067g Moscow AVIATSIYA I KOSMONAVTIKA in Russian
No 1, Jan 88 (signed to press 2 Dec 87) pp 24-25 [Text]



Key:

1. "You are intercepted. Follow me." (FOLLOW). During the day by wagging the wings, at night by blinking navigational and landing lights at uneven intervals

2. "Understood, complying." (WILCO). During the day by wagging the wings, at night by blinking navigational and landing lights at uneven intervals.

3. Slow level turn onto course

4. "Your path clear. You may continue flight according to plan." (PROCEED). Climbing turn of 90 degrees or more without intersecting aircraft's course

5. "Descend to land." (DESCEND).

6. "Land at this airfield..." (LAND...). During the day by lowering the landing gear and overflying runway in direction of landing, at night by additionally turning on landing lights continuously.

6904

USSR Law Applying to Alert Duty

91440067h Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 1, Jan 88 (signed to press 2 Dec 87) p 26

[Article by Lt Col Justice S. Kuznetsov: "Alert Duty and the Law"]

[Text] Reliable protection of national air space is part of the overall system for ensuring national security. In this regard alert duty is a very important aspect of Air Forces activity. While on a responsible watch the personnel of alert flights and teams have to be ready for immediate and decisive actions to destroy if necessary enemy air attack weapons on distant lines. To accomplish this mission every military aviator who is part of a team is obligated to occupy his post in the shortest possible time at the first signal and mobilize his efforts, knowledge and experience to the utmost.

Alert duty is a special service; its performance is the execution of a combat mission even in peacetime. Servicemen of all categories (officers, warrant officers [praporshchiki] and first-term and extended-term servicemen) are used for this responsible matter. Alert duty at airfields, radiotechnical posts and control posts can be performed by duty crews or ships appointed by orders of appropriate commanders. Duty shifts themselves can consist of several combat teams which man equipment and gear in turn.

Organization of alert duty, preparation of personnel and equipment for it, and functional duties of appointed persons are regulated by special standardized documents: regulations, manuals, statutes, instructions and orders of appropriate commanders and chiefs.

Infractions of alert duty rules can be manifested as nonperformance or negligent performance both of general requirements established for duty forces and resources, as well as of specific duties of aviators making up those forces. I believe it is not superfluous to explain that these infractions can be manifested both in an action and, conversely, in inaction. For example, unauthorized departure from the room or from the territory of a duty subunit, use of alcoholic beverages and sleeping at the post are considered infractions. It may be the unsanctioned switch-on of gear or leaving it unattended, admitting outside persons to the gear, or imposing certain duties on them. Switching on equipment late, ceasing observation without authorization, detecting a target late or reporting its appearance late, missing targets or signals, violating rules for target search or tracking them along false routes are serious offenses. It is inadmissible to receive any kind of information with distortions and not to ensure its timely passage or that it reaches the troops in a timely manner. Great harm can be done by deliberate or careless disabling of equipment, bringing unserviceable equipment for duty or using servicemen for duty who do not have authorization.

Experience indicates that the principal reasons for infractions most often are poor organization of the preparation of duty forces and resources for going on alert duty, poor monitoring of the performance of alert duty, personal lack of discipline, and incomplete understanding by individual servicemen of their responsibility for performing missions assigned to the duty subunit.

I have to say that legal propaganda and in general the legal indoctrination of military aviators still do not meet the demands of the time in a number of collectives and have poor influence on strengthening military discipline and order, on increasing the responsibility of personnel for the Motherland's security, and on exemplary performance of duty. Commanders, political officers and we military jurists are at fault for this. Classes and talks on legal topics often are reduced to the reading or retelling of articles of our laws and military regulations and do not leave a deep imprint in people's memory. The "legal propaganda corners" in barracks, staffs and duty forcehuts reek of dullness and boredom. Individual indoctrination work with personnel who are inclined to violate discipline often is replaced by loud dressings-down and threats of stern measures of disciplinary and criminal liability. Such an approach hardly facilitates a deepening of aviators' legal knowledge or the instilling of respect for laws in them.

Meanwhile increased demands on the professional, moral-political and psychological preparation of personnel of duty forces and resources and the task of comprehensive activation of the human factor give rise to an insistent need for reinforcing the legal indoctrination of military personnel. Every pilot, technician, mechanic, and communications or rear specialist who goes on duty must firmly know his rights and duties and be aware of his degree of responsibility for committing unlawful acts.

There is criminal liability for infractions of alert duty rules. It is borne by any serviceman who is part of a combat team of a duty subunit. Servicemen who are part of the duty crew, post, and duty section of a combat team bear criminal liability for an infraction of rules for performing duty regardless of whether or not the infraction was committed during the immediate attendance of gear and equipment or during rest.

Article 21 of the USSR Law "On Criminal Liability for Military Crimes" (Article 257 of the RSFSR UK [Criminal Code] and corresponding articles of criminal codes of other union republics) has several paragraphs. Paragraph "a" provides punishment for an infraction of alert duty rules without the occurrence of serious consequences. The measure of punishment is imprisonment for from one to five years. If these acts were committed under extenuating circumstances, application of rules of the Code of Disciplinary Punishment of the USSR Armed Forces is possible in accordance with Pararaph "b" of this Article. Facts characterizing both the infraction as well as the person who committed it can be recognized as circumstances mitigating responsibility in each specific instance.

An infraction which involves serious consequences is punished in accordance with paragraph "c" of this Article by imprisonment for a period of from three to ten

years. Serious consequences are taken to mean intrusion of foreign aircraft into USSR air space, loss of life, disabling of combat equipment, nonperformance of a combat mission and so on.

The crimes envisaged by paragraphs "a" and "c" committed in wartime are punished by execution or imprisonment for a period of from five to fifteen years regardless of the occurrence of serious consequences.

If in addition to an infraction of alert duty rules the serviceman also commits another crime (absence without leave, mutilation, deliberate destruction or damage of military property and so on), he is liable for the aggregation of crimes, since he is simultaneously infringing on several objects protected by the law.

Alert duty always is a test of moral staunchness, professional expertise and military maturity of aviators. Strict compliance with prescribed alert duty rules by all servicemen serves as the basis for inviolability of our state borders and of USSR air space.

6904

Requirements for Simulator Training Improvement Detailed

91440067i Moscow AVIATSIYA I KOSMONAVTIKA in Russian
No 1, Jan 88 (signed to press 2 Dec 87) pp 28-29

[Article by Col N. Gostev, Honored Military Pilot USSR: "Simulator Training: Restructuring in Training; What is it to be Like?"; first paragraph is AVIATSIYA I KOSMONAVTIKA introduction]

[Text] Training in aircraft cockpits and on simulator gear during preliminary preparation serves to reinforce and restore skills which flight personnel acquired in the process of general training and which are needed for upcoming flights.

I recall an instance where the flying techniques of flight personnel of one of the units were to be checked under the hood on back-up instruments, but weather intevened. Then it was decided to organize such "flights" on the simulators. According to exercise conditions the AGD [remote gyro horizon] was to be disconnected. One had to be there to see the expression on the aviators' faces when they learned about this. They didn't conceal their agitation, and there were reasonable grounds for this as the pilots were rather afraid of the simulators.

Results of the "flights" turned out to be poor. Twelve out of seventeen pilots checked received unsatisfactory marks. What was the matter? Where did combat pilots get a fear of simulators and uncertainty in their actions? We looked into it and learned that during the year the flight personnel had not practiced actions on the simulators with the remote gyro horizon disconnected. Moreover, some appointed persons simply had ignored simulator training. They had to be corrected and persuaded that it was impossible to be reconciled with that situation.

This example shows that problems sometimes arise where there should not even be a hint of them. Use of aviation simulators in the training process is a demand of the time. They are the aviators' mainstay in perfecting combat proficiency and improving flight quality and safety. The presence of a large number of flying and navigating instruments and special gear on modern aircraft requires flight personnel not only to have detailed theoretical knowledge, but also firm skills in operating aviation equipment. These skills have to be developed in the course of training classes on simulators, on special stands and in aircraft cockpits.

Combat pilots today have advanced simulators at their disposal on which they can practice flying techniques, tactical employment, navigation and much more. Practices on them best contribute to flying improvement, flight safety and moral-psychological conditioning. In a number of cases, however, they are not always used with high effectiveness in the spirit of demands for restructuring of the training process, and not all subunit commanders take a businesslike and thoroughly aware attitude toward them to an equal extent. There are also those who assume that a "flight" on the simulator is of no benefit; worse, it gives pilots harmful skills in flying techniques because of design imperfection.

As a matter of fact, that which satisfied us just yesterday often demands accelerated renewal and replacement today. And of course, a critical view (inherent to a time of restructuring) of the organization of the training process is necessary. But even if we take into account the aviators' just complaints about the operation of some simulators where reliability and design leaves much to be desired, we cannot agree with such judgements. They are not only erroneous, but also harmful. Any aviation simulator can be of much benefit with good class organization. The fact is that the quality of practice sessions depends above all on how training is tied in with the working of flying exercises and the extent to which its content corresponds to actual work in the air.

Consequently we have to plan each pilot's training so that his authorization to perform a new mission or kind of combat training is preceded by mandatory practice of necessary skills on simulators, in the aircraft cockpit, on special stands, in the form of accomplishing various tasks and in the form of a run-through.

It has become the rule in foremost subunits that simulator training in the overall training system is to be conducted in accordance with programs of training classes of the Combat Training Course and to the extent

necessary for flight personnel to maintain confident professional skills. The list of exercises for each pilot is established by his commander. The number of practice sessions and their periodicity depend on the quality and intensity with which flights are performed. As a rule the number of training sessions increases during breaks in flight operations.

It is common knowledge that skills acquired during simulator training are quickly lost and so the training classes have to be conducted not occasionally, but regularly and with a mandatory analysis of their results.

There are many examples where a complicated situation was created in the air which demanded mental staunchness, proper assessment of the dangerous moment and instantaneous decisionmaking of the combat pilot. In such situations the quality of aviators' ground training usually tells. If they have prepared thoroughly and have thought and worked out their actions in all phases of the upcoming flight and in each specific special instance, they will fly the aircraft confidently and precisely. Conversely, superficial ground preparation for a flight leads to indecisiveness and at times also to errors.

For example, where can a pilot practice his actions in special instances? On the simulator, of course. Many special instances in flight are given in instructions to the crew of any aircraft, and a pilot's actions in response to such an instance are indicated. Aviators remember some recommendations easily, and others with difficulty. Therefore the unit methods council has to work out a precise system for training the flight personnel based on their training level, periodicity of simulator training, and features and content of missions to be accomplished. Of all the diversity of special instances noted in the instructions the methods council should select the most difficult ones for mastery (above all those representing the greatest danger for a pilot) and put them together into groups, denoting them arbitrarily by A, B and C. In other words, it should determine specifically what is to be practiced on the simulator. Such an approach will allow the commander to concentrate his attention on the principal factor and exclude formalism in this important matter.

It is best to establish the periodicity of practice sessions for each difficulty group of exercises, such as daily for group A, once a week for group B and once a month for group C. The remaining special instances should be worked during preliminary training in classrooms, in aircraft cockpits and on practice areas for running through dismounted flight training as necessary and under the direction of immediate commanders. Such necessity can be caused by the assignment of new missions, by erroneous actions of some pilots in preceding flights, by an analysis of preconditions for flying incidents or by direction of higher headquarters.

It is important to arrange a strict accounting of pilots' practice of actions in special instances. The flight commander must do this. The deputy squadron commander works in this direction with the flight commanders, the squadron commander with his deputies, the deputy regimental commander with the squadron commanders, the deputy for flight training with chiefs of services of regimental headquarters, and the regimental commander with his deputies.

From a methods standpoint simulator training must take place in a certain sequence. First there is a study of instructions to the pilot (flight operation manual) and practice on the procedure of actions in the aircraft cockpit. Then there is a repetition of these actions on the simulator. And finally there is the main period, the sudden creation of an emergency situation in the course of a practice session, and the situation has to be changed in place and time. Every simulator "flight" has to be strenuous to the maximum for the pilot. Only practice sessions of this sort generate aviators' interest in them, activate their minds and accordingly raise the level of simulator training.

Practice sessions have an especially important role in retraining pilots on modern aviation equipment. A situation is considered to be normal where a new simulator is installed and in operation in the unit even before the beginning of this process, but that does not always happen in practice. Often mastery of new types of aircraft proceeds without the use of simulators. This has a negative effect both on quality and on time periods for retraining. The principal reason is the slow construction of buildings for simulators and the long time periods of start-up and adjustment work done by representatives of the manufacturing plants.

I will give an example. A simulator arrived in one of the air garrisons of the Carpathian Military District in December 1984. It was in the depot for a little over two years with its storage period being one year. The start-up and adjustment work dragged on as a result of the failure of many electronic units and other gear. Installed in March of last year, the simulator still is not operating, and this in the period of restructuring and acceleration of intensification of the training process!

As we know, the commander is the first to answer for flight safety. His wisdom lies in eliminating flying incidents and preconditions therefore, and being able to prevent undesirable phenomena in flight operations while striving for high results in combat training. It is a question of repetitive errors of flight personnel. A commander has to react promptly to them and conduct extensive preventive work, including simulator "flights." Ignoring this will lead to undesirable consequences sooner or later.

Second Class Military Pilot Capt V. Sychugov took off, but the engine suddenly shut down at an altitude of around 150 m. A bolt which fastened the air intake cone ring had fallen into the compressor through the fault of ground services. Sychugov was not ready for such a situation and so acted incorrectly. He did not take steps

to gain necessary altitude for safe ejection using his existing speed, but made a forced landing away from the airfield without lowering the landing gear as prescribed by the instructions to the pilot of an aircraft of this type.

In fact it was a difficult but not hopeless situation. There would have been no trouble had the pilot acted precisely and correctly without losing a second. This can be achieved only by regular practice sessions in aircraft cockpits or on simulators.

From the very beginning the unit attached no importance to features of operating this type of aircraft and to its limitations, nor did it perceive the danger concealed in engine failure on take-off. Necessary steps were not taken and this had an immediate effect on flight safety.

There is a good saying that a picture is worth a thousand words. This relates fully to attaining the objective of simulator "flights." Experienced pilots know that even the best theoretical classes, excellently executed methods diagrams, and qualified explanations of senior commanders will not be able to substitute for the simulator "flight." Unfortunately, aviation simulators are used with insufficient effectiveness in some units, with average flying time on them being from 3 to 7 hours on a workday during the year. Such "flights" should have been arranged in two shifts so that there were at least 10 flying hours a day.

It happens that some commanders remove themselves from direction of simulator "flights." Such an erroneous practice does not allow for quality training of flight personnel or a study of aviators' strong and weak points to the full extent.

Second Class Military Pilot-Instructor Capt S. Groza was making a night flight in simple weather conditions. Soon the airfield was covered by low clouds. Mistakes were made in controlling the crew, but the pilot himself also acted incorrectly. He continued on the landing approach in weather conditions in which he was not trained to operate. He should have radioed the flight operations officer about the presence of low clouds, made a second circle at the prescribed altitude and landed at an alternate airfield, but he did not do this.

Why did that happen? The reason became obvious after a detailed analysis of the unsuccessful flight. It turned out that preparations for the flight session had been conducted poorly in the squadron without using simulators and without working out special instances in flight. Capt Groza himself ignored common truths: practice on the ground, think over the assignment in detail, and create nonstandard situations mentally. As a result his lack of composure and personal lack of discipline led to mistakes where they were not expected of an experienced pilot.

There is no greater harm than when people see the separation of their training from life and its oversimplified nature. It is no secret that such flagrant facts as inflated reporting of simulator "flights" also occur in some subunits. This relates in particular to flight personnel who are the leaders. This is done rather simply. The operating time of simulators from the time they are switched on to the time they are switched off is counted for the pilots as real flying time. And so it turns out that the life of costly simulators is being used up uselessly, electric power is being expended and irreparable moral damage is being done to flight personnel. Can we really continue to be reconciled with this? Of course not.

Now, when restructuring is going on in aviators' work along all avenues, it is necessary that it also touch on the organization of pilots' simulator training. This is a major reserve for improving their professional expertise and consequently for improving combat readiness and flight safety.

6904

Success Through a Change in Regimental Engineer's Work Style

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No 1, Jan 88 (signed to press 2 Dec 87) pp 34-35

[Article by Maj S. Manyukov: "The Turning Point"]

[Excerpt] Lt Col N. Breymurov, deputy regimental commander for aviation engineering service, emerged from the hall where the Military Council session was in progress with the feeling of a person who had thrown off a heavy load. It was pleasing to learn that his regiment had become the leader of competition among air units of the Red Banner military district. Although the honor of being decorated with an order or being presented a valuable gift had not befallen him as it had some of his colleagues, he took the modest encouragement—removal of previously imposed punishment—with satisfaction.

Just a few months ago the regimental aviation engineering service had been called the worst in the district air force from the high rostrum and the deputy regimental commander for IAS [aviation engineering service] had been severely punished. He, Lt Col Breymurov, knew better than the others what difficult work of engineers, technicians and aviation specialists it had taken to win back the lost positions. Therefore the most essential thing for him now was that they had succeeded in bridging the gap. He knew well into what kind of tangled ball official concerns are interwoven when pressed together by the stress of combat training. He didn't spare himself. Sometimes he would come home toward morning but could not fall asleep despite being very tired. Troubling thoughts agitated him. In such moments the entire life he had lived would surface in his memory.

For the sake of service in the Army, the most important thing in his life, Breymurov had left behind the tranquil comfort of Kiev, the interesting work of designer, and a collective in which he was respected and esteemed. After serving the prescribed period in the Army he was released to the reserve, but a year later he decided to return to places that were far from vacation spots, where the winds that knock a person off his feet and the severe freezing temperatures of the Transbaykal test both metal and humans for reliability day in and day out. He returned and served eight years.

The posts, districts, ranks and positions changed: he was aircraft technician, TECh [technical maintenance unit] chief, and aircraft and engine engineer. One thing remained unchanged: when the aviators assembled with their families for ceremonial meetings on holidays his name too would sound from the rostrum. The admiring gazes of his wife and young son when he received a certificate, valuable gift or other award from the commander's hands were a cherished reward. Probably then he could not even suppose how sharply the customary rhythm of life would be changed by one telephone call.

The senior chief was brief:

"You are to depart immediately for N-sk. You are taking over the position of deputy regimental commander for aviation engineering service."

In his first duty days at the new location he tried to do everything—see, understand and assess—himself. Moreover the regiment had equipment in the inventory which he previously had not encountered. He had to study it almost from scratch. The more he delved, the more often he would notice features contradicting his previous impressions of the work of aviation engineering service specialists. He noticed in particular that technicians' work was not organized everywhere with identical precision. He expressed his criticism, but the reaction was cool. The collective apparently had become accustomed to that way. He decided to check the quality of equipment preparation and back up his demands with examples.

It was not without agitation that he began inspecting the first aircraft. It turned out that he had not intervened in vain. His engineer's intuition did not let him down: he discovered a hidden complex defect which threatened engine shutdown in the air. Somewhat later he also found the original cause. It lay in the fact that the engine had been inspected by the customary method without the optical instruments specially designed for this. He ordered that they be drawn from the depot and used as prescribed.

When a technician discovers something of this sort he is usually commended, but the instance with the regimental engineer went by unnoticed as if nothing had happened, although in the first weeks of duty at the new location he too needed support and a good word. This probably also would have added to his authority.

In time he began to realize that he was not succeeding in being everywhere himself and that one can't solve all problems in isolation. Alas, they did not always achieve positive results. At times holes would be patched hastily because of extreme stress. Moreover, he did not immediately find a common language with all subordinates. Difficulties built up.

Nikolay Yegorovich did not hide them; to the contrary, he repeatedly spoke at meetings in the regimental headquarters primary party organization and shared what was troublesome. He repeatedly requested Party Buro Secretary Officer V. Zabolotnyy to give attention to problems of the aviation engineering service and indoctrination of specialists. There was a reaction to this, albeit a very unique one. Breymurov remembers how they listened to his account with the stereotyped wording "on personal contribution." He was unexpectedly invited to a buro session and had to give an impromptu account without preparation. He was criticized at that time and it was recommended that he "improve and strengthen." He emerged from the session devastated, for even before the hearing he realized that he himself had to constantly "put on speed," but there just was no businesslike, specific assistance in working with the people or remedying deficiencies.

But he didn't stop there. At a meeting he proposed analyzing the work and giving an appraisal of each party member's personal contribution to the common cause and of the attitude to official and party duty. A representative of the higher political department present at the meeeting also supported Breymurov. The vote was unanimous.

But again he himself had to give an account. An exercise was coming up and so the question was specific: readiness of aviation equipment for operational training actions and results of camouflage measures. He reported the shortage of camouflage resources and the heavy load resting on the shoulders of engineers and technicians. Again he requested help in shifting matters from a standstill through joint efforts, and again all the concern was contained in several lines of the minutes: "Point out to Comrade Breymurov the need to think out how to get technical personnel to the zone in an alert, and the absence of T/O&E resources for camouflage of aviation equipment. Recommend holding a competitive review for best aircraft camouflage."

If one ponders the meaning of the decree, it is not difficult to perceive the position of some party members: These are your problems, Comrade Breymurov; you solve them. But the fact is, aircraft will not be concealed by wordings and papers, and so he left the hearing with empty hands.

The strenuous days of the LTU [tactical flying exercise] at an alternate airfield were memorable. The people worked enthusiastically, even with a certain obsession. Capt A. Kryuk, Sr Lt I. Payusov, WO [praporshchik] N.

Shevchenko and many other specialists spent their days and nights, as they say, in 30-degree temperatures at the aircraft readying them for sorties. They complained neither about the absence of conveniences nor about the cold room where they were accommodated. There was just one irritation that generated gloomy jokes among engineering-technical personnel—the bright "uaziks" with the eternally scurrying monitors and questions such as "Well, will you cope? Take care!" No, that wasn't the kind of attention, attention cloaked in external fussiness, that he had requested from the party rostrum.

They worked conscientiously in the tactical flying exercise. As before, the people and their attitude toward the job saved the day. One would like to believe that the exercise helped bring about a turning point in the situation and helped make the people cohesive, but new problems arose in the daily succession of events. The intensity of combat training grew and new reserves for intensifying flight operations came into play. It was then (probably for the first time in all his service) that Lt Col Breymurov sensed how inexorably this tempo compressed time. An anxious concern appeared: Will I pull the load to which I harnessed myself? He worked long and hard but sensed that there was not much return from this. It turned out that he was simply duplicating the work of the regimental engineers and at times also deputy squadron commanders for aviation engineering service.

That methodology probably justified itself earlier when his officer career l an; however now when the appearance of aviation was dynamically changing it not only did not conform to acceleration but, to the contrary, retarded forward progress. It is no simple matter, however, to reject methods which for years had seemed stable.

More than once he asked himself the question: Why do the people have little initiative? He recalled an episode at the hardstand. He was checking the quality of technicians' work and giving instructions. The deputy squadron commander for aviation engineering service and the aircraft and engine engineer followed him silently, looking at what was occurring apathetically. There was nothing else for them to do inasmuch as he had completely taken hold of solving problems that were fully within their abilities. Just where was independence?

The opinions of colleagues also forced him to ponder. At one party meeting Party Member N. Lutsko stated frankly: "I believe that engineers in the specialties are substituting for group chiefs. They even do the troubleshooting themselves."

Breymurov decided to change the work style of his assistants, the engineers. He specifically assigned tasks for each person in order to break them of partiality for petty coddling. Subsequently he held a unique critique.

"How is the work organized in the squadrons?" he asked Maj V. Gumennyy after the latest flight section.

"On the whole normally," responded Gumennyy confidently and began as usual to enumerate work on the aircraft which he had done himself.

"You again worked for the technicians but lost sight of the aircraft preparation schedule. And what was the result?"

The deputy regimental commander for aviation engineering service had telling grounds for dissatisfaction. Once a precondition occurred through the fault of the senior flight engineer. Officer Zabolotnyy, the flight operations officer, categorically stated: "I will record the precondition against the engineer!"

Had Breymurov heard that from someone else, he would have restrained himself. The engineer was really guilty, but the fact was that quite recently there had been a conversation for the umpteenth time with Zabolotnyy, buro secretary of the headquarters primary party organization.

"There was a decision to have a hearing for engineers Gumennyy and Lutsyuk. All time periods have expired. Why isn't it being carried out?" asked Nikolay Yegorovich.

That time as well the secretary avoided a direct answer. That was why this sudden outburst of "principle" stung Breymurov so painfully. The fact is that had the party buro intervened promptly the engineer possibly would have had a different attitude toward the job during flight operations, so that if judged conscientiously, this precondition also was caused by the secretary's indifference. It was a pity that there was no such point in the flight laws.

There was no time for a heart-to-heart conversation as the flight section was in full swing. He didn't contain himself and struck out rashly:

"I also can punish you! According to regulation, as deputy regimental commander!"

He met his match this time. That was when Zabolotnyy found and pointed out the paragraph in the flight operations manual which stated that the flight operations officer is directly subordinate to the regimental commander.

And so they parted with neither budging. Soon Breymurov sensed that the wall of the secretary's alienation had become even firmer.

It was not easy to solve the problems. It was not enough that a multitude of them had arisen; now subordinate officers A. Belov and A. Vlasov had begun to commit disciplinary infractions. He talked with them more than once and turned for help to buro members and to the

secretary personally. They responded when they had to look into the personal affairs of both persons for their partiality for alcohol. Breymurov recalled how his personal file also had been examined a little earlier. The discussion was about several days of the tactical flying exercise.

6904

Cold-Weather Operation of Aircraft Engine Fuel-Metering Equipment

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[Article by Lt Col P. Karpenko and Lt Col Yu. Kuzmin, candidate of technical sciences: "Under Low Temperature Conditions"]

[Text] It is common knowledge that there are unique features in the operation of aviation equipment during the fall and winter period. For example, at this time more attention must be given to the operation of power plants and their automatic equipment. Fuel-metering equipment (TRA) of modern aviation engines functions reliably in a wide range of temperature, pressure and ambient air humidity readings in the most diverse climatic zones.

Experience indicates, however, that in this period the quality of fuel-metering equipment maintenance substantially influences its operating effectiveness. The importance of specific inspections rises especially. In the course of power plant inspection specialists pay serious attention to airtightness of connections of fuel and oil systems having cup packings and rubber stuffing-box seals, since their elasticity deteriorates in low temperatures as a result of insufficient cold-resistance of packing rings.

Sharp temperature fluctuations also have a negative effect on the working capacity of aviation equipment. Moisture which condenses on fuel-metering equipment components at this time enters clearances between components and then on freezing expands the clearances. A fuel leak because of this is discovered only in an operating engine in the course of a rise in fuel (oil)-temperature. Ice crystals forming during condensation on filter elements and in nozzles and lines can lead to the appearance of other malfunctions. For example, the freezing of air nozzles in automatic starter or acceleration control assemblies usually leads to a "hot" acceleration hang-up in the process of starting a gas-turbine engine. Moisture condensation on microswitches degrades the insulating properties of their components, which (depending on the purpose of the microswitch) can entail premature starter disengagement or fuel cut-off.

These and other factors demand strict compliance with requirements set forth in operating manuals, instructions and unified regulations, and the performance of particular jobs ensuring reliable equipment operation during the fall-winter period. In some cases this means mandatory preheating of appropriate components of machine units and systems and in others it is a check of nozzle condition. These same documents also give recommendations for remedying typical failures. For example, when the low-pressure fuel filter ices up in the process of starting and the "Dirty Filter" panel lights up the filter should be heated by warm air and condensate which has formed should be drained. It is also necessary to heat the filter pack and dry it well. To keep nozzles from freezing, before starting use warm air to heat the fuel pump-regulator, paying special attention to the condition of the air filter.

Many aircraft are operated under conditions in which it is impossible to completely protect their power plants and automatic fuel equipment from atmospheric precipitation, salt water spray, or a strong wind carrying sand and dust. One of the primary tasks of IAS [aviation engineering service] specialists here is to prevent various extraneous particles and admixtures from getting into the fuel, and here is why. Despite the fact that all basic elements of automatic fuel equipment are reliably protected against entry of outside particles through the use of appropriate filters, one still does not always succeed in fully precluding malfunctions of fuel-metering equipment for this reason. This basically occurs because of mistakes of aviation engineering service personnel.

The corrosiveness of aviation fuels caused chiefly by the presence of such substances as water, sulphur and certain chemical compounds in the fuel also causes much trouble. Special additives are used to prevent them from forming in the fuel. The additives considerably reduce the corrosion process or prevent its development entirely by forming a protective film on the metal surface. In some cases the fuel dehydration method is used, with corrosiveness reduced severalfold.

We would like to recall one other feature of operating aviation equipment in the fall and winter period. It is common knowledge that the greatest amount of water gets into fuel from its condensation on the cooled surface of tanks and the fuel itself. The presence of water in fuel can be easily detected visually and it is relatively simple to remove. It is considerably more difficult to determine the presence of a water emulsion, which under certain conditions is capable of leading to freezing over of filtering elements of the GTD [gas turbine engine].

Nevertheless, the presence of free water in fuel represents the greatest danger for fuel-metering equipment. Preconditions are created here for electrochemical corrosion of components and machine units of the fuel-metering equipment. This process is manifested by the appearance of rust spots, local darkening, and minor point affections of insignificant depth on the metal

surface. Subsequently the process is accompanied by formation in the fuel of suspended, finely divided brown flakes consisting of iron hydroxides. They can plug up filters and nozzles. Although the mass accumulation of particles in the clearance of a slide valve during operation of fuel-metering equipment is an unlikely phenomenon, it is impossible to completely exclude its appearance. Depending on the design of precision pairs, increased friction here may reach considerable amounts and lead to fuel-metering equipment failure. Under certain conditions it is enough for a single soft (plastic) particle (including certain corrosion products) to get into the slide valve for it to fail.

Water in fuels in the presence of sulphur mercaptan reinforces the corrosion process even more. As a result its products appear on the bronze and cadmium components of fuel-metering equipment and they also can clog filters, nozzles and other system components.

The time of the beginning of corrosion formation, which depends on various factors (concentration of water in the fuel, presence of dead zones in machine units, damage to components' oxide films), varies from several hours to hundreds of days. Corrosion products can lead to the most diverse consequences: shutdown of the gas turbine engine, acceleration drop or hang-up and the like. Therefore during the maintenance process it is necessary to promptly drain the fuel residue, monitor the appearance of free water in it and take account of all features mentioned above.

The presence of water in fuel leads to its poor lubricating capacity, and this is one of the possible causes leading to grabbing in plunger pairs of fuel pumps. This process appears in the form of a galling of bronze particles on the steel surface. If breakdown products do not get into the clearance in the process, then the only thing that occurs is the plunger's hang-up in the sleeve (without the pump's pumping assembly being disabled). This usually involves an impact interaction of plungers with the bearing race, with gradual damage to component material at contact points. Characteristic pump noise appears here which allows identifying the trouble before components break down fully and before a sudden failure occurs.

Since a high level of contact loads always exists in plunger pairs, then subsequently there is an intensive breakdown of plunger faces and of the surface of the bearing race coupled with them as a result of the plungers freezing in rotor wells because component breakdown products have gotten into the clearance and rubbing surfaces grab. The presence of water in fuel, which increases the coefficient of friction in the pair, is one of the most dangerous factors affecting the working capacity of plunger pairs.

Machine unit failures because of the presence of a large quantity of antiwater crystallization (PVK) fluid in the fuel happens no less frequently. The fluid is added to prevent fuel filters from becoming plugged with ice crystals forming in fuel tanks in negative temperatures. The features of these fluids' physico-chemical and operating properties are their high hygroscopicity and possibility of forming an emulsion and sediments (if the requirements of guidance documents on features of operating gas turbine engines on fuels with antiwater crystallization fluids are not followed).

Such fuel-metering equipment failures arise only from violations of requirements for gas turbine engine maintenance. Fuel systems of modern aircraft are designed so that any formation of water in the fuel does not cause engine malfunctions. For example, on aircraft with an installed and operating system for delivering antiwater crystallization fluid, ice crystals are automatically removed by the supplied antiwater crystallization fluid as they accumulate on the filter in response to a signal indicating increased pressure differential on the fuel filter with simultaneous illumination of the "Dirty Filter" panel.

Thus to prevent fuel-metering equipment failures under conditions of low ambient temperatures it is necessary to hold regular practices with personnel in which they are taught to correctly drain the fuel residue and monitor the presence of water in it, and to properly fill aircraft and helicopters, including with antiwater crystallization fluids. Aviation engineering service leaders must reinforce supervision over prompt performance of these jobs and over the cleanliness of fuel and other components being used.

Only by having an excellent knowledge of engine fuel-metering equipment, features of its operation, grades of fuel being used and methods of determining its quality and by exercising vigilant supervision over the technology of servicing in accordance with existing maintenance guidance documents is it possible to achieve high reliability and constant combat readiness of aviation equipment, create favorable conditions for the flight crew's effective work in the air, and ensure flight safety.

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History of Air Combat

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[Conclusion of article by Col Yu. Kislyakov, 1st Class Military Pilot; and Col (Res) V. Babich, candidate of military sciences: "History of Air Combat: Great Patriotic War (Third Period)"*]

[Text] While the second period of the Great Patriotic War was characterized as the fundamental turning point in its course, the third period (January 1944-9 May 1945) was characterized as the crushing defeat of the fascist bloc.

In 1944 our fighters already had both quantitative and qualitative superiority over the enemy and were operating under conditions of the strategic air supremacy they had won. The ratio in aircraft numbers was 2.7:1. Aircraft General Designer A. Yakovlev, creator of the famed "Yak's," wrote as follows about the qualitative state of aircraft: "Of course our combat aircraft were immeasurably simpler in design and technology than the American or German machines, and this was their advantage. They were adapted for production under the most difficult conditions of the first period of the war: the evacuation and the acute shortage of aluminum, instruments, and a large number of materials needed for mass production of aircraft, engines and equipment. They were easily placed in production in the East by the hands of unskilled workers, primarily women and teenagers. With all this our aircraft met completely the stern conditions of the air battle against the world's strongest air fleet, that of Hitler Germany."

Chief Mar Avn A. Novikov, CIC of the Air Forces during the war, supplemented the description of the first component in the indivisible "equipment-tactics" connection, the component comprising the basis of any combat. He wrote: "Not having found what to use to counter our new 'Yakovlevs' and 'Lavochkins' which had indisputable advantages over all modifications of the Me-109 and the FW-190, Willi Messerschmitt began to increase the armor protection, firepower and speed of his aircraft. But since these improvements were at the cost of a weight increase, the Me-109, which was excellent from a technical flying standpoint, finally was transformed from a light front fighter into a heavy fighter, lost its previous maneuverability and got no advantages over Soviet fighters." (This violated the third principle of aerial combat, the link of maneuver and fire.)

Our designers also modified their aircraft, but they chose the most reliable way by strictly adhering to the specific purpose of the combat aircraft: they improved only those qualities which permitted fighters to remain fighters, attack aircraft to remain attack aircraft, and bombers to remain bombers. The precisely defined functionality of equipment also produced the proper combat effect. Of course, this required a large number of aircraft, but the rear coped with this extensive and complicated task. A reliable air shield was created over the ground troops in 1944.

Troop cover, which took almost half (47 percent) of the combat life of fighters, was supplemented by the important mission of supporting the successful actions of other air arms. Bombers, the principal striking force, considerably expanded their sphere of actions and began to fly to greater radii. The deeper they intruded into enemy air space, the more encounters there were with his fighters. They were unable to reliably protect themselves with their own weapons against the Messerschmitts and Focke-Wulfs even though they put all their effort into this, and so fighter protection was required.

It would seem that the life of fighter pilots, who had received a quantitative and qualitative advantage, should have improved in the third period of the war, but supporting the sorties of other air arms proved not simply a complicated mission, but also a very dangerous one, for which fighters expended 37 percent of their combat life.

The principal difficulty was that the support mission doomed them to defensive combat, but there simply was no other method of accomplishing that mission. By the way, no method has been found to the present time, as shown by the experience of local wars unleashed by imperialism where jet aircraft of three generations fought. When there was reliable protection the results of bomber actions usually rose, which cannot be said for the fighters, whose calling is free offensive combat.

In this case freedom was shackled by being attached to strike aircraft. Like a sentry, the escort fighter could not leave its post and go away from the escorted object without losing fire coordination or visual contact with it. The escort fighter's only right was to cut off an attack and return to position, but that procedure was almost precluded in protecting the rear hemisphere, from which the principal threat came. Thus regardless of the support forces, the escort fighters could not actively attack and could only beat off. The pilots did not make full use of the equipment's increased combat capabilities (the fourth principle of combat was violated). The opposing sides' chances in combat evened out despite the fact that quality was on our side.

As experience showed, escort difficulties were of an objective nature. They were fully felt later, for example, by American fighter pilots in Vietnam, who assigned enormously more aircraft than the composition of the strike group to protect the bombers. They still were unsuccessful, however, and allowed productive attacks by North Vietnamese Mig's. As we see, history left the tactical problem of escort unresolved by all fighters regardless of whose they were.

The experience of combat against fascist Me-163, Me-262 and He-280 jets which appeared at the front in 1945 shows what freedom of maneuver (which provides initiative and the right of choosing offensive procedures) means for the fighter pilot. High level and vertical speeds allowed the pilots of these aircraft to attack suddenly and break off an attack freely. The turn radius increased because of the high speed, however, which hampered them in taking up an initial position for closing. The time for the attack and for aiming also shortened and actions were hampered in an adverse weather situation (clouds, limited visibility). In addition, the brief duration of the flight of jets with rapid fuel consumption shortened their radius of action and chained them to their airfields. The flight of these aircraft was revealed from far off by the trace of smoke and tongue of flame from the nozzle.

Our fighting men were to take skillful advantage of the shortcomings revealed in the new German aircraft's tactical employment on encountering them. Meanwhile pilots even of single-engine Me-163's did not enter open combat with our fighters. They would hunt lone aircraft which had broken off from a group, taking advantage of everything to achieve surprise. Stratagem was used. For example, a pair would separate vertically, with the lower aircraft demonstrating an attack and the upper one attacking, taking advantage of the results of the dummy attack. Soon this procedure, well known from past actions, was perfected: inasmuch as a steep dive at high speed was contraindicated for jet aircraft, the demonstration maneuver was executed by the upper pilot followed by an attack from below. (This procedure often was copied later by Israeli fighter pilots in actions in the Near East during 1970-1980.)

After a study of enemy tactics it was recommended that our fighter pilots conduct pair combat: when closing on a collision course one pilot would simulate a frontal attack and the other would take up a position for attacking at the moment the enemy deviated. If a threat arose from the rear, one pilot would turn sharply horizontally, letting the jet aircraft get in front, while the second pilot would climb and choose the moment for the attack. The principal requirement which had to be fulfilled by our fighter pilots was to search in the distance and not permit concealed closing to within firing range.

The first combat of our propeller-driven Yak-9u and La-7 aircraft with jets did not produce a good result since the high speed gave the enemy better conditions for protection. Success finally came. Triple HSU I. Kozhedub describes one of his combat actions as follows.

"We were conducting an air hunt not far from the front line. I was watching the sky carefully. An aircraft suddenly appeared from the south, from the direction of Frankfurt at an altitude of 3,500 m. It was flying along a lake at the top speed for our Lavochkins. It was a jet! I turned quickly, gave the engine full throttle and pursued the enemy. The pilot obviously was not looking backward, relying on his high speed. I tried to cut the distance and approach beneath the 'belly' of the aircraft with a slight descent. . . . The distance was 500 m. A successful maneuver and quickness of actions allowed me to approach the enemy. But what was this? Tracers were flying at him: my companion Dima Titarenko was hasty and my plan of action was irreparably foiled. But against all expectations his tracers helped me: the German aircraft began to turn left toward me. The distance shortened abruptly and I closed with the enemy. I opened fire with involuntary excitement and the jet fell, breaking to pieces."

The outcome of this action was decided by the surprise of the attack prepared by a concealed closing and a maneuver to approah within range of fire. Obviously it was not for nothing that surprise was put in second place among principles of aerial combat after aggressiveness (combat activeness).

The third period of the war was characterized by an increase in the number of fights conducted by bombers and attack aircraft, with the latter often not conducting defensive combat, but preplanned offensive combat using the fire of their cannon and rocket projectiles. Unfortunately we have not succeeded in gathering summary data on results of aerial combat of the pilots and gunners of attack aircraft and bombers, although some of them have 6-7 air victories apiece, which is a very substantial contribution to results of the struggle for air supremacy.

No small role in the overall success of actions by our fighter pilots in the third period was played by the warning and ground-controlled intercept system that was set up and was augmented by radars. The Redut radar permitted us to solve the problem of destroying enemy bombers in a new way. Ordinarily information about the appearance of enemy aircraft came to the fighter command post from visual observation posts at the moment the enemy aircraft overflew the front line. Duty subunits in readiness at airfields would not have time to intercept the enemy at the desired line; therefore they had to maintain patrols in the air, expending aviation life and the physical efforts of flight personnel.

To obtain information about the enemy from a line extended onto enemy territory, for example, Gen I. Dzusov's large unit had the practice of having aircraft on duty in the air with suspended tanks, permitting them to remain in loitering zones for 2.5-3 hours. In clear weather at an altitude of 6,000-7,000 m these air observation posts could view space to a greater depth than ground posts. But there was no systematic use of such a technique, as the air posts themselves required protection and would not be put out when the weather worsened.

Radar stations located 10-15 km from the front line would detect enemy aircraft 12-15 minutes before they approached the battlefield. This permitted fighters to take off after notification, climb, and enter combat in a timely manner and from a tactically advantageous position inasmuch as the leader would receive information about the enemy's position from a radio located together with the radar at the ground-controlled intercept post. The principle of economic expenditure of forces began to be fulfilled without reducing combat effectiveness: a total of over 2,000 enemy aircraft were shot down with the assistance of ground radars.

Control of fighters in combat also was formalized once and for all in the third period of the war. Experience showed that the flight was the largest group in which a commander could successfully direct pairs and even each crew if necessary. A group consisting of four aircraft or more would split up after the first attack and interworking between the pairs would not be restored, but the commander of a flight was capable of working out the most probable combat options in detail and allocating duties among pilots in the air. Two or three prepared

options permitted quickly finding the necessary solution and shifting to actions under a new plan without wasting valuable time thinking it out.

The independence of pairs and flights and granting of greater initiative to the leaders of small groups led to a certain decentralization of control, but did not disrupt it. When missions were accomplished at the squadron level the commander would coordinate actions of flights, determine the sequence of their commitment and direct the assembly. After the beginning of maneuverable combat the flight commander would be given full right to control his wingmen. Experience also showed that the squadron commander could not monitor and direct actions of more than 2-3 flights (in accordance with his plan). In those cases where a large number of aircraft was used for participation in combat, control was exercised by several squadron commanders not subordinate to each other. The large unit commander would coordinate their actions from his command post (with attached radar); he always had a reserve at his disposal which he used to build up efforts in combat.

Special significance was attached to teamwork and cohesiveness of pairs and flights under conditions of the transformations which were being carried out. A pair did not break up in combat and was the primary fire and tactical unit. Visual contact and fire coordination was constantly maintained between pairs. A division into groups with different tactical purposes began at the flight level. One group always was an attack group and another was a cover group, but their functions alternated in the course of combat: after disengaging from an attack the attack pair would cover the wing pair which had gone into the attack. A squadron would be divided into three groups: one flight or pair was assigned as a reserve which usually was situated above the covering flight. It is typical that the reserve would include experiernced combat pilots with the right to make independent decisions on commitment based on the situation. Essentially this was a "free maneuver" group.

Allocation of efforts in a three-echelon combat formation reflects the decision made by Lt Col Dankevich in one of the April actions of 1945. After detecting a two-tiered mixed group of German aircraft he gave the command: "I am attacking the lower echelon. Cover flight attacks the upper tier ahead of me. Reserve is to withdraw into the sun and attack those departing upward." The cover flight was first to enter combat and crowded the enemy escort upward. The reserve pair attacked the enemy suddenly out of the sun and shot down two aircraft. Not encountering resistance from the escort, which was tied up in combat, Dankevich's strike group attacked a six-bomber group. One of them was knocked down. The others, having rapidly dropped their bombs, turned to a reverse course. However, our pursuing fighters also lost two aircraft. IN this short account the evaluation of the situation, the battle concept, the plan and its achievement (resolution), and the routine character of the introduction into battle of a group of different tactical assigments are particularly apparent.

Soviet pilots in La-7 and YaK-9 aircraft of the latest modification reliably increased their combat records and improved the indices of air battles. If in 1943 for one of our losses, three enemy aircraft were knocked down, then in 1944 it was 3.2 and in 1945 it was 5.4. The following were the general totals for the entire war: in air battles 44 thousand enemy aircraft were knocked down. Our losses were 12,189 aircraft (of all types). The corelation was 3.6:1, that is, 3.6 fascist aircraft for one of our aircraft lost.

The history of the air war from 1941 to 1945 has the richest content. All of the chapters of the "book" were written in the blood of our air warriors, and each of them contains valuable experience, beneficial for study and use in modern conditions. This means in particular methods of training pilots, the planning of battle, the structuring of combat formations, the methods and equipment for the conduct of battle, the organization of cooperation,and the meaning of the morale factor. The components of victory over a powerful air enemy are particularly clearly expressed in the principles of air battle formulated during the war: offensiveness (combat aggressiveness); surprise; the connection between maneuver and fire; full use of the combat capabilities of the technology; close cooperation and firm command and control; detailed knowledge of the enemy and the wisdom to make use of his weak sides; continual improvement of tactics. And, unconditionally, these principles cannot be fully realized without the unwavering belief of our air warriors in the future victory. Precisely the belief in victory, the force of our own weapons, selfless love for the motherland and hatred for the fascist aggressor, and professional mastery lifted the combat morale of Soviet pilots and helped them to seek the effective way to the destruction of the hated enemy.

Reviewing the method of the preparation for combat, it is necessary to noted, that in aviation units and formations exercises on tactics and equipment, seminars and conferences at which experienced air combatants told about valuable tactical methods which they had found in the course of harsh engagements are regularly conducted with the personnel. The science of winning is passed down in this way.

In August of 1943 at one of the airfields near Moscow a Higher officers air combat school was created. It was headed by an experienced pilot and combat commander, Major General of Aviation A. Zhukov. The school's organization included from the beginning two aviation regiments equipped with YaK-1, Yak-3, La-5 and La-7 aircraft. In addition one squadron had captured aircraft on which instructors having front-line experience carried out air battles with the students in the manner of fascist pilots. The school's students—commanders of wings, squadrons and flight crew from reserve regiments—

studied their own and enemy tactics, flew in air battles and firing, and then applied the knowledge received when at the front. Up to the end of the war the school yielded more than 300 commanders and air combatants who were professionally literate, in tactics and piloting skills.

At present air battle, as a complex military phenomenon, has in large part been transformed. Firm tendencies which have been recalled in articles have been demonstrated, including: the widening of the space occupied by air battle; the dispersal of the combat formation; the decrease in the number of aircraft participating in a single battle; "offensive" fire in maneuver; the priority significance of all-aspect missile weaponry. However, close maneuver group battle has not lost its significance. Therefore, its law are preserved and all recommendations left to us in the heritage of the fighter pilots of the terrible forties are quite topical.

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